

FINAL REPORT
Y/SUB/85-00206C/7

Presence of Uranium in Ground Water in the Bear Creek Valley Waste Disposal Area

Prepared for

MARTIN MARIETTA
ENERGY SYSTEMS, INC.
Oak Ridge, Tennessee

NOVEMBER 1985

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Date of Issue: November 1985

Y-SUB/85-00206C/7

PRESENCE OF URANIUM IN GROUND WATER
IN THE BEAR CREEK VALLEY WASTE DISPOSAL AREA

Prepared by
Geraghty & Miller, Inc.
Under Purchase Order 12Y-00206C

For
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee 37831
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
Oak Ridge, Tennessee
for the
U.S. DEPARTMENT OF ENERGY
Under Contract No. DE-AC05-84OR21400

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1.0 INTRODUCTION

1.1 PURPOSE

In September 1985, Martin Marietta Energy Systems, Inc., (Energy Systems) requested Geraghty & Miller, Inc., (G&M) to prepare this report on uranium detected in ground water in the Bear Creek Valley Waste Disposal Area (BCVWDA) at the U.S. Department of Energy's (DOE) Y-12 Plant in Oak Ridge, Tennessee (Figure 1). The report is essentially a summary of references to uranium contained in G&M's June 1985 report to Energy Systems entitled "Remedial Alternatives for the Bear Creek Valley Waste Disposal Area," which was prepared in response to the regulatory requirements described below.

1.2 REGULATORY FRAMEWORK

Representatives of the DOE signed a Memorandum of Understanding (MOU) on May 26, 1983, with the U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Health and Environment (TDHE) relating to control of contamination at the Y-12 Plant. The MOU was modified by a TDHE Complaint and Order dated December 1983. In June 1984, Energy Systems submitted to DOE a report entitled "Preliminary Assessment of Existing Contamination in Bear Creek Valley Watershed Area and Potential Remedial Actions for Mitigating Its Impact on Bear Creek." That report reviewed the history of waste disposals in Bear Creek Valley, presented general concepts for controlling the contamination,

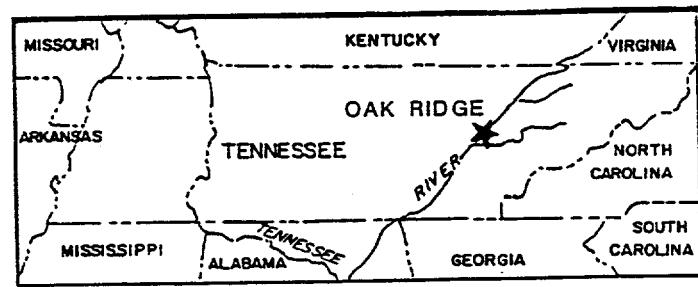
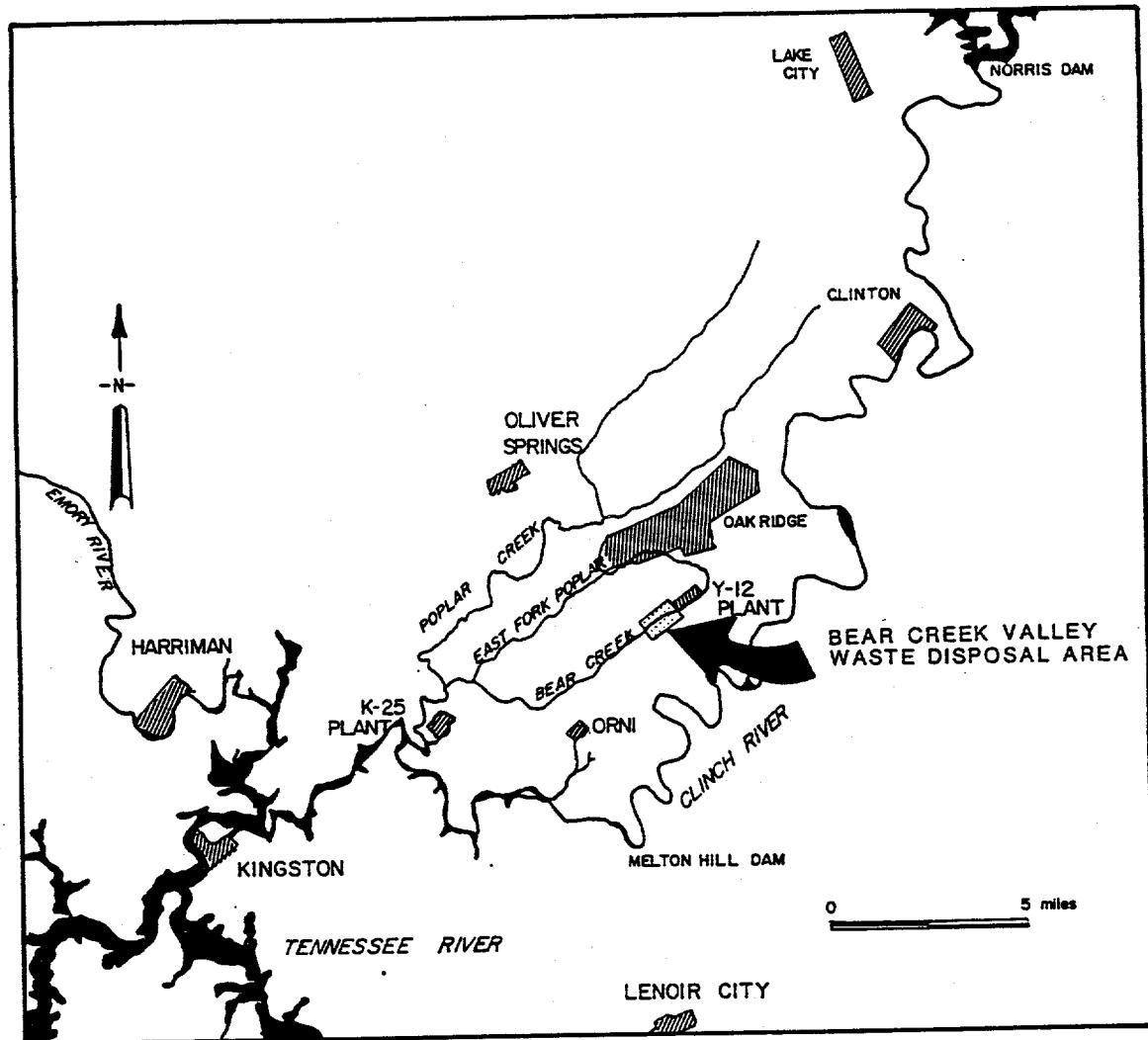


FIGURE 1. LOCATION OF THE Y-12 PLANT AND THE BCVWDA

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and established a plan and schedule for evaluating remedial-action alternatives. One year later, the Y-12 Plant issued the above-referenced G&M report that described four alternative remedial-action plans developed in response to the requirements of the regulating agencies. That report is currently under review.

1.3 DESCRIPTION OF THE Y-12 PLANT AND THE BCVWDA

The Y-12 Plant, operated by Energy Systems, was built by the U.S. Army Corps of Engineers in 1943 as part of the Manhattan Project. Its original mission was to separate the fissile isotope of uranium from natural uranium by the electromagnetic process; after World War II, that process was discontinued in favor of the gaseous diffusion process. Since then, the plant has developed into a highly sophisticated organization that (1) produces nuclear weapons components in support of DOE's weapons design laboratories, (2) processes special materials, (3) supports other installations in Oak Ridge and in Paducah, Kentucky, and (4) supports other governmental agencies.

The BCVWDA consists of three principal waste-disposal sites, the S-3 Ponds, the Oil Landfarm, and the Burial Grounds, situated over a distance of roughly two miles in the valley of Bear Creek (Figure 2). The valley, which extends in a general west-east direction, is bordered on the north by Pine Ridge and on the south by Chestnut Ridge. Bear Creek flows westward through the valley to drain into East Fork

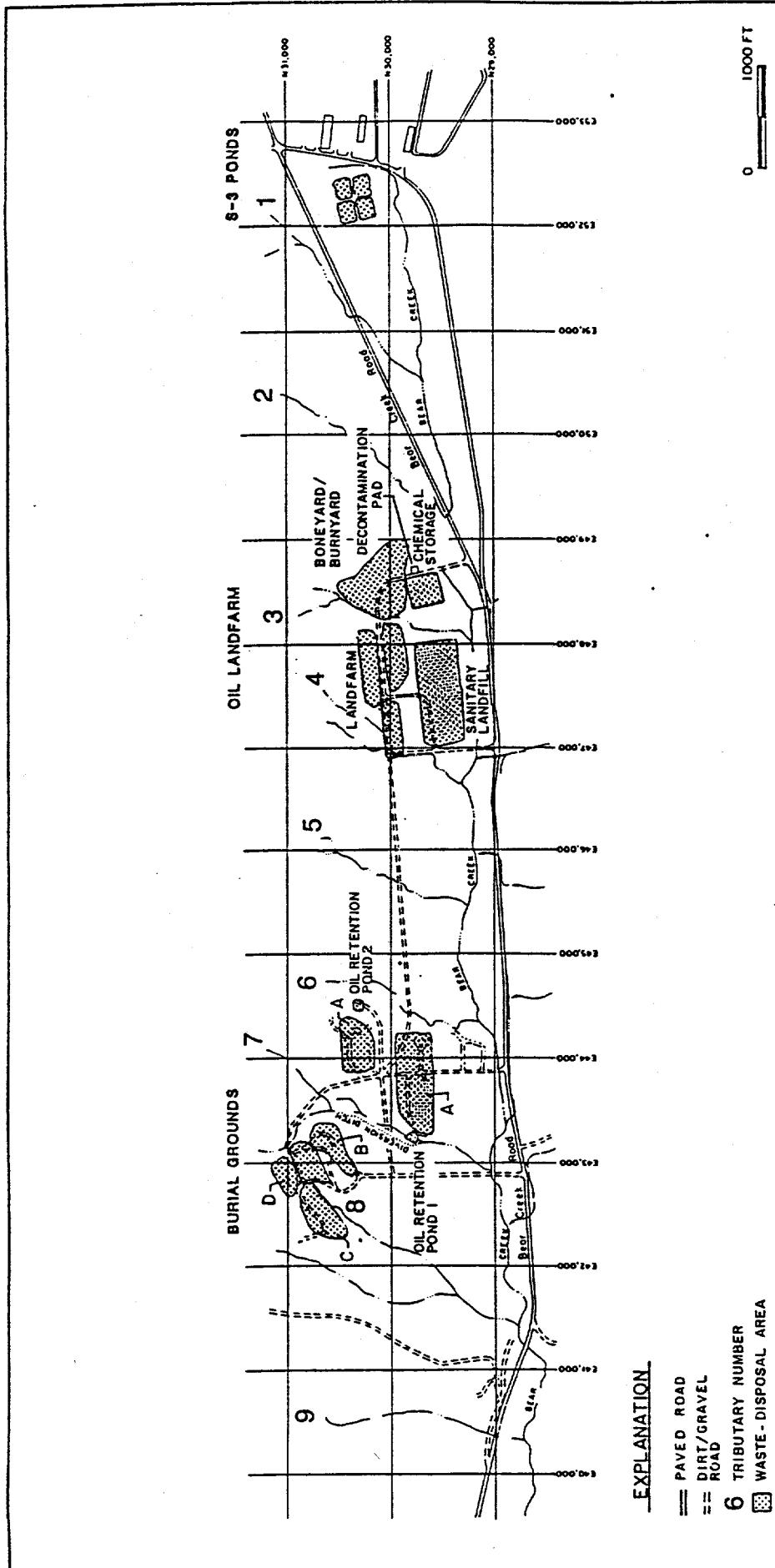


FIGURE 2. BEAR CREEK VALLEY WASTE DISPOSAL AREA

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Poplar Creek, which empties into Poplar Creek, a tributary of the Clinch River. The underlying bedrock formations consist largely of stratified shales and limestones, overlain by unconsolidated soil materials derived from weathering of those rocks. The BCWWDA has been used since 1951 for disposal of a wide variety of wastes, including uranium and solid waste that contained some residues of uranium.

An extensive monitoring network is in place at the waste-disposal areas to detect contaminants. The network includes more than 150 monitor wells, all of which have been sampled periodically for chemical analysis. The locations of these wells at the three principal waste-disposal areas are shown in Appendix A. Construction details for wells installed in 1983 and 1984 are presented in Appendix B. The following sections of this report deal exclusively with evidences of uranium contamination at these monitoring points.

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2.0 WASTE-DISPOSAL AREAS

2.1 S-3 PONDS

The S-3 Ponds were built in 1951 as a disposal site for liquid wastes. In the 1950's uranyl nitrate solutions containing trace amounts of transuranics and other fission products were placed in the Ponds. At later dates, depleted uranium in nitric acid solutions, raffinate, and condensate containing technetium and transuranics, as well as small lots of miscellaneous solid materials, were added. The inventory list includes dilute acids, machine coolants, caustic solutions, biodenitrification sludges, and concentrated acids.

2.2 OIL LANDFARM

The Oil Landfarm was first used for disposal of waste oils and coolants in early 1973, and the site remained in use until 1982. A program for analysis of oil samples for uranium, beryllium, thorium, and PCBs was implemented in 1979. Prior to that date, the waste oils and coolants were not specifically analyzed for contaminants before application to the Oil Landfarm. For the purposes of this document, the Oil Landfarm site also includes the Boneyard, Burnyard, Sanitary Landfill, Decontamination Pad, and the Chemical Storage Area.

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2.3 BURIAL GROUNDS

The Burial Grounds encompass several principal sites designated as Burial Grounds A, B, C, and D and two Oil Retention Ponds. Each burial ground consists of a series of trenches. The first trench in Burial Ground A was excavated in August 1955 for the disposal of solid wastes. In July 1959, the Y-12 Plant began using this facility for the disposal of liquid wastes from floor cleaning operations, referred to as mop waters. Inventory records show that additional wastes disposed of in the Burial Grounds were heavy metals, including beryllium and uranium, oils and coolants, salts, debris, solvents, EDTA, asbestos, and materials contaminated with radioisotopes.

Burial Ground B was opened in 1962 for the disposal of depleted uranium metal and oxides. Burial Ground C was opened in 1962 for the disposal of beryllium, beryllium oxide, thorium, and solid waste contaminated with these materials; other materials contaminated with enriched uranium also were disposed of in Burial Ground C. Burial Ground D was used after 1968 for the disposal of depleted uranium metals and oxides after Burial Ground B had reached capacity. An area of the Burial Grounds referred to as the Walk-In Pits was used from 1966 to 1981 for the disposal of chemicals and pyrophoric uranium metal saw fines. Since 1981, the Walk-In Pits have been used solely for the disposal of pyrophoric uranium metal saw fines.

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3.0 PRINCIPAL AREAS OF CONTAMINATION

3.1 OVERVIEW

The variability of the wastes placed in the BCVWDA over a period of more than 30 years reflects changes in manufacturing processes and waste-treatment methods at the Y-12 Plant, and does not permit the delineation of plumes of contamination in ground water attributable to specific sources of wastes. The areal extent of ground water contaminated by uranium activity in the BCVWDA is shown in Figure 3. The map depicts average conditions in 1984; boundaries of the plumes are only approximate and the contaminant concentrations at shallow depths may vary seasonally in response to the infiltration of rainfall. The vertical extent of contamination is presently being investigated through the sampling of recently installed deep monitor wells.

Data on uranium activity in ground water, in picocuries per liter (pCi/l), are presented in Appendix C. The radioactivity of specific uranium isotopes in virtually all analyses is well below DOE's guidelines of maximum permissible concentrations (see Appendix E, Table 4). Uranium concentrations, in parts per million (ppm), in ground water are presented in Appendix D.

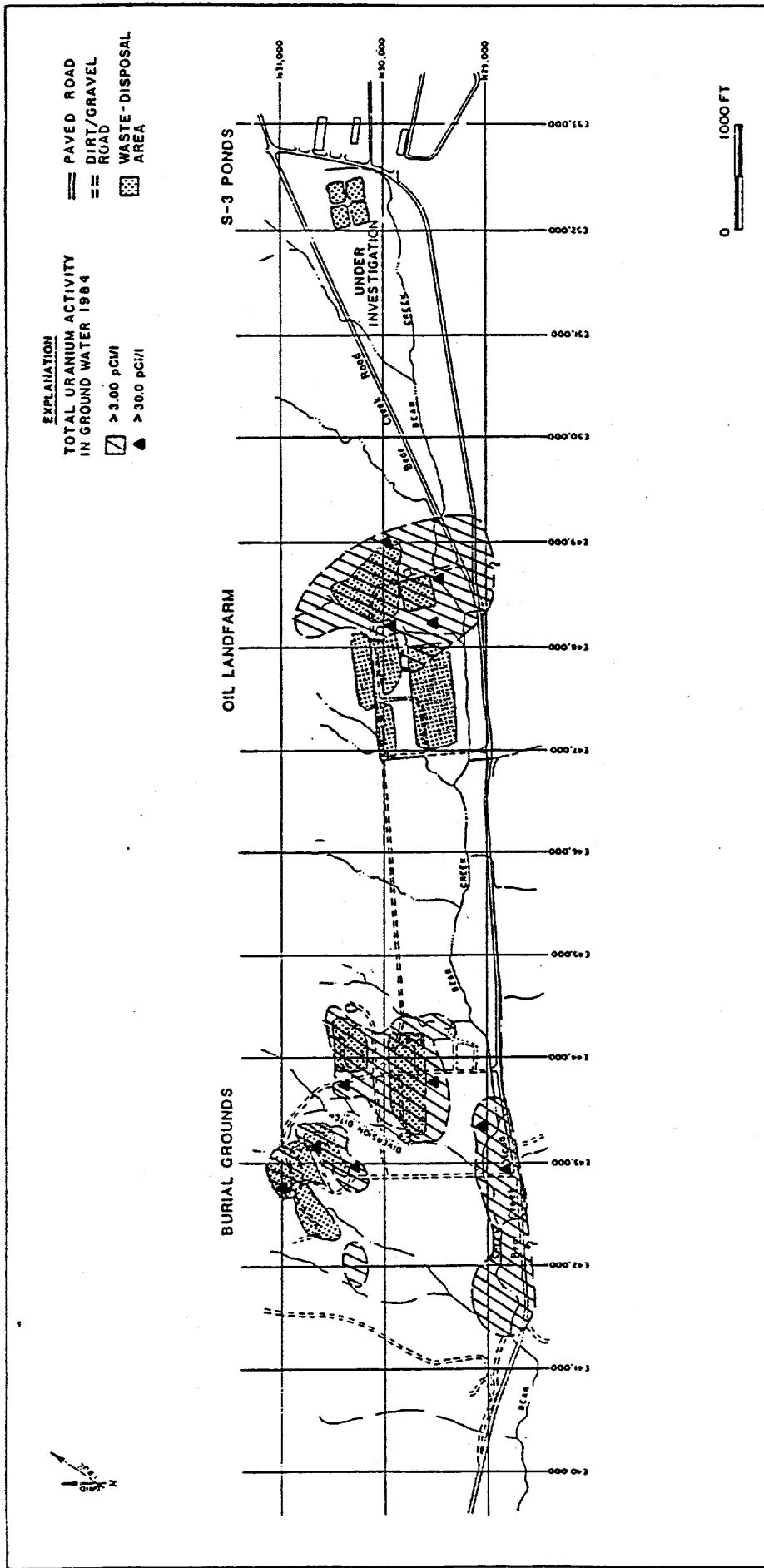


FIGURE 3. APPROXIMATE AREAS OF GROUND-WATER CONTAMINATION BY URANIUM ACTIVITY.

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3.2 S-3 PONDS

An investigation of the presence of uranium in ground water is currently under way, and the results should be available by late 1985 or early 1986. Thus far, only one round of ground-water samples from the wells shown in Figure A-1 has been analyzed for the presence of uranium (Appendix D). Five out of the ten samples collected in the spring of 1984 contained uranium in concentrations equal to or exceeding 2 ppm. The highest concentration, 45 ppm, was in well GW-103 (10 ft deep). None of the water samples were analyzed for uranium activity.

3.3 OIL LANDFARM

Four sets of ground-water samples have been collected from wells in the Oil Landfarm and analyzed for total uranium activity (Appendix C) and uranium concentrations (Appendix D). The samples were collected in the fall of 1983, the spring and summer of 1984, and the summer of 1985; different wells were sampled during each round. The most complete round was in the spring of 1984, and the data used to depict the plume characterized by uranium activity at the Oil Landfarm in Figure 3 were for the most part from this sampling round. The results from the most recent sampling round will be available in late 1985 or early 1986.

Figure 3 shows that the highest levels of uranium activity at the Oil Landfarm were found in samples from the

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vicinity of the Decontamination Pad and the Chemical Storage Area; total uranium activity ranged from 34 pCi/l (well GW-86) to 395 pCi/l (well GW-87) in the spring of 1984. In August 1984, however, the data indicate that uranium activity in well GW-86 was less than 1 pCi/l and that the activity in GW-87 was greater than 500 pCi/l. Elevated uranium activity was detected in ground-water samples from wells GW-62 and GW-63, which are located south of Bear Creek. These wells also have shown elevated concentrations of other constituents, such as volatile organic compounds, and the source of these contaminants is unknown. Water-table maps indicate that the wells are not downgradient of the Oil Landfarm, the Chemical Storage Area, or the Decontamination Pad, and it appears unlikely that these sites are the sources of the contamination. Also, the wells were drilled through the Bear Creek cavity system, and it is possible that the contaminants could have been carried in the cavities and/or in Bear Creek from upstream. A sample from well GW-43, an upgradient well, had a uranium activity of about 4 pCi/l in the spring of 1984; the source is unknown.

The vertical distribution of uranium activity in ground water is illustrated in Figures 4 and 5. The shallower wells generally show higher activity levels than deeper wells; this is illustrated particularly at well clusters. For example, in the spring of 1984, uranium activity in well GW-5 (10 ft deep) was 42.0 pCi/l and in well GW-76 (80 ft deep) was 1.25 pCi/l. Similarly, uranium activity in wells GW-86 (30 ft

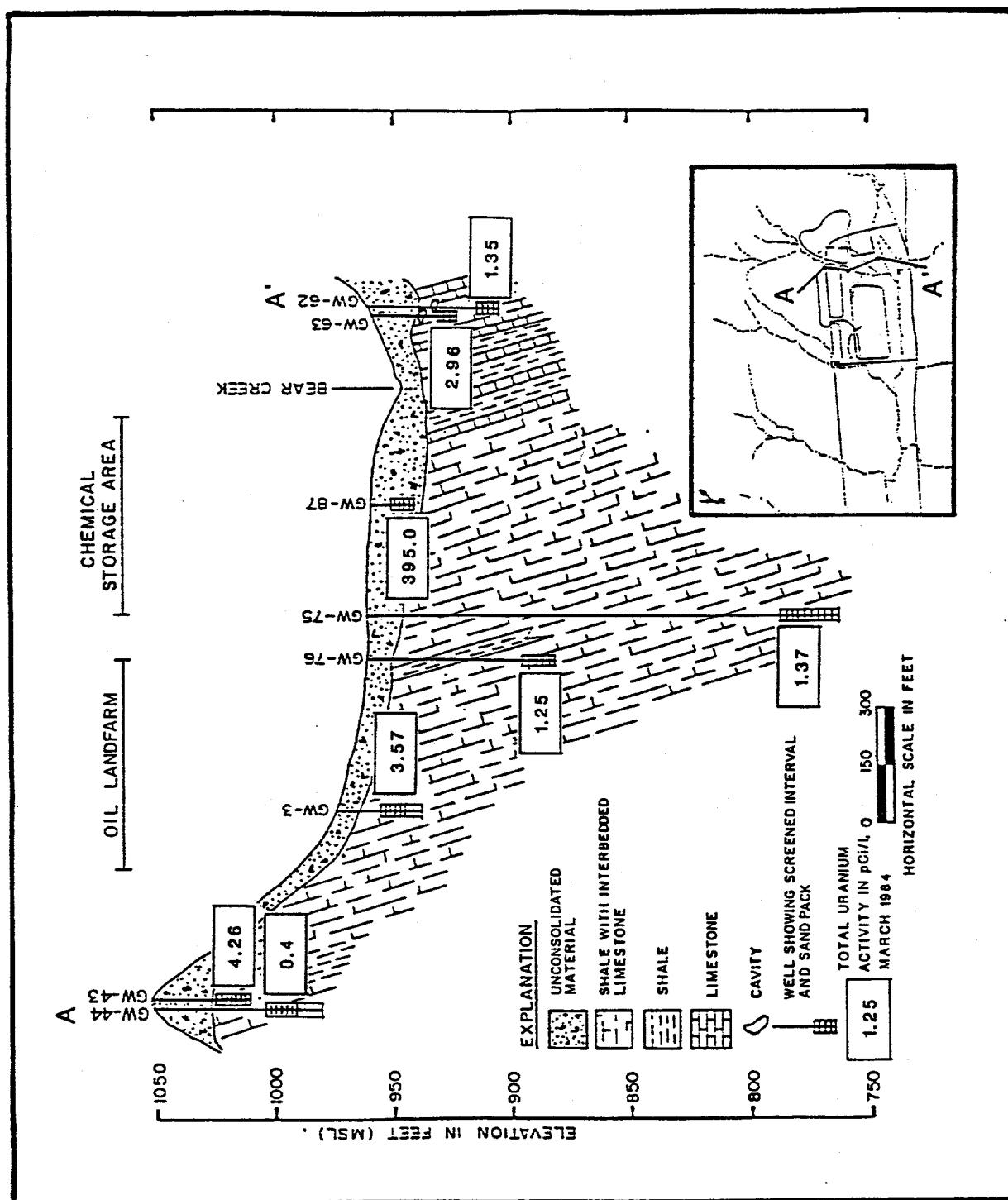


FIGURE 4. CROSS SECTION A-A' SHOWING TOTAL URANIUM ACTIVITY IN GROUND WATER AT THE OIL LANDFARM

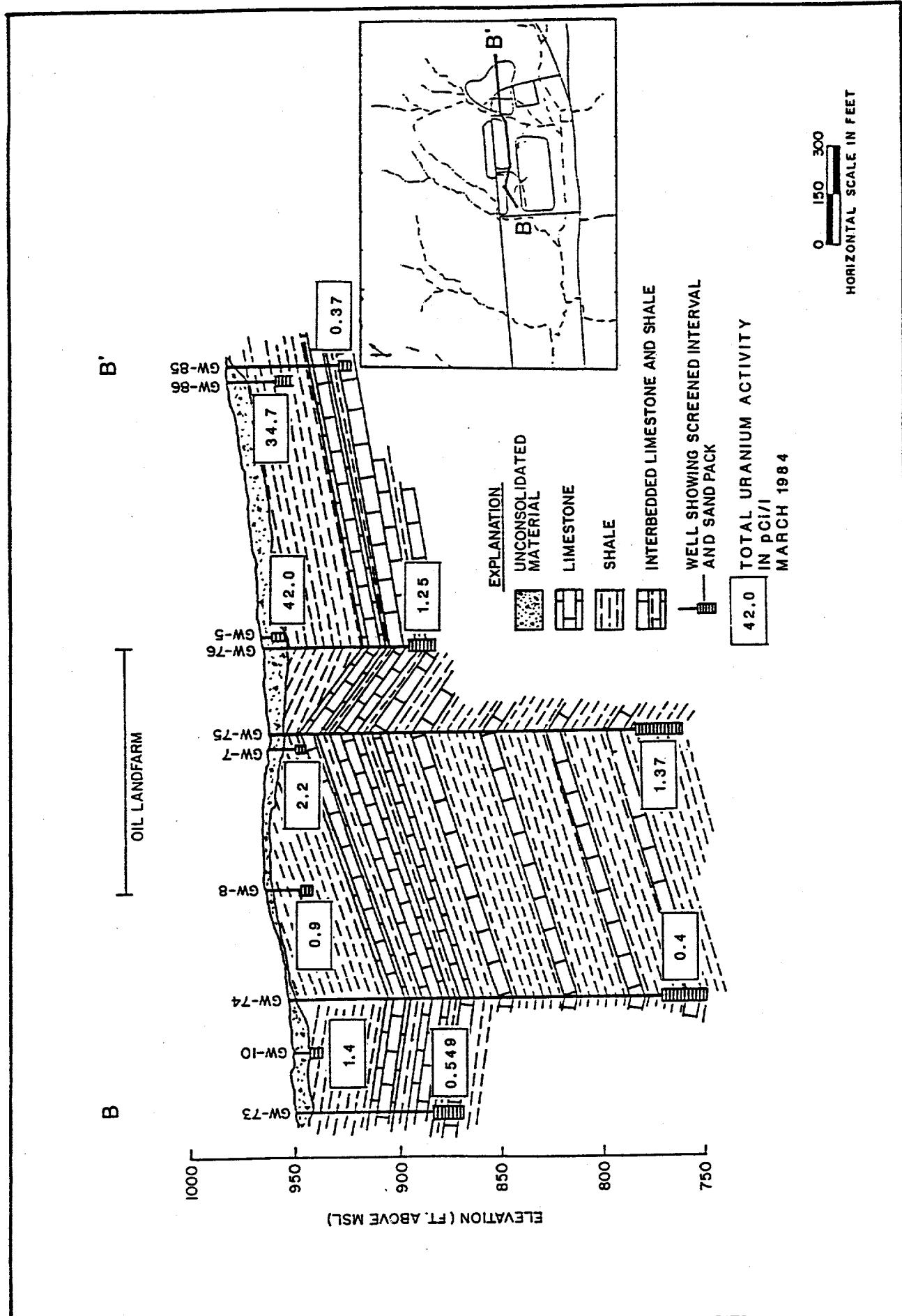


FIGURE 5. CROSS SECTION B-B' SHOWING TOTAL URANIUM ACTIVITY IN GROUND WATER AT THE OIL LANDFARM

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deep) and GW-85 (59 ft deep) was 34.7 and 0.37 pCi/l, respectively. During the same sampling round, uranium activity in wells GW-67 (16 ft deep) and GW-66 (55 ft deep) was 48.1 pCi/l and 0.44 pCi/l, respectively.

With the exception of well GW-87, the ground-water samples from the wells at the Oil Landfarm show generally stable or decreasing levels of uranium activity. The data on uranium concentrations indicated that all ground-water samples had a concentration of less than 2 ppm.

3.4 BURIAL GROUNDS

Four sets of ground-water samples were collected from wells at the Burial Grounds and analyzed for uranium activity (Appendix C) and uranium concentrations (Appendix D) in the fall of 1983, the spring and fall of 1984, and the summer of 1985; different wells were sampled during each round. The data from the most recent round should be available in late 1985 or early 1986. The most comprehensive round, spring 1984, was the principal source of data for Figure 3, which shows that the highest levels of radioactivity in ground water at the Burial Grounds are at Burial Ground A, isolated areas at Burial Grounds C and D, and an area adjacent to Bear Creek. Within each area, there are instances of total uranium activity in excess of 30 pCi/l; values as high as 985 pCi/l (well GW-23) have been determined. Uranium concentrations in samples from the Burial Grounds wells were all less than 2 ppm.

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The uranium activity levels in ground-water samples from wells GW-59, GW-60, and GW-61, all on the south side of Bear Creek, were about 10 pCi/l in the spring of 1984. The source of uranium is not clear; samples from several wells between these three wells and the Burial Grounds have been characterized by lower activity levels. Wells GW-59, GW-60, and GW-61 were drilled through the cavity system, and it is possible that contaminants could have migrated through this system from sources other than the Burial Grounds. Also, Bear Creek has elevated levels of uranium activity in the vicinity of these wells, and it is possible that infiltration of contaminated water from the creek could be the cause.

The vertical distribution of radioactivity in ground water in the spring of 1984 is shown in Figures 6 and 7. The pattern of lower activity levels with greater depth is not evidenced at the Burial Grounds as it is at the Oil Landfarm. A sample from well GW-70 (140 ft deep), for instance, showed uranium activity at 30.9 pCi/l. The adjacent well, GW-69 (99 ft deep), showed uranium activity at only 0.84 pCi/l. Samples from another cluster, GW-71 (219 ft deep) and GW-72 (98 ft deep), had almost identical uranium activity levels: 0.89 pCi/l and 0.86 pCi/l, respectively. Similarly, wells GW-58 (44 ft deep) and GW-59 (25 ft deep) had uranium activity levels of 11.48 and 8.99, respectively. Three wells extend to depths of 100 ft or more: wells GW-70 (140 ft deep), GW-71 (219 ft deep), and GW-77 (100 ft deep). Samples

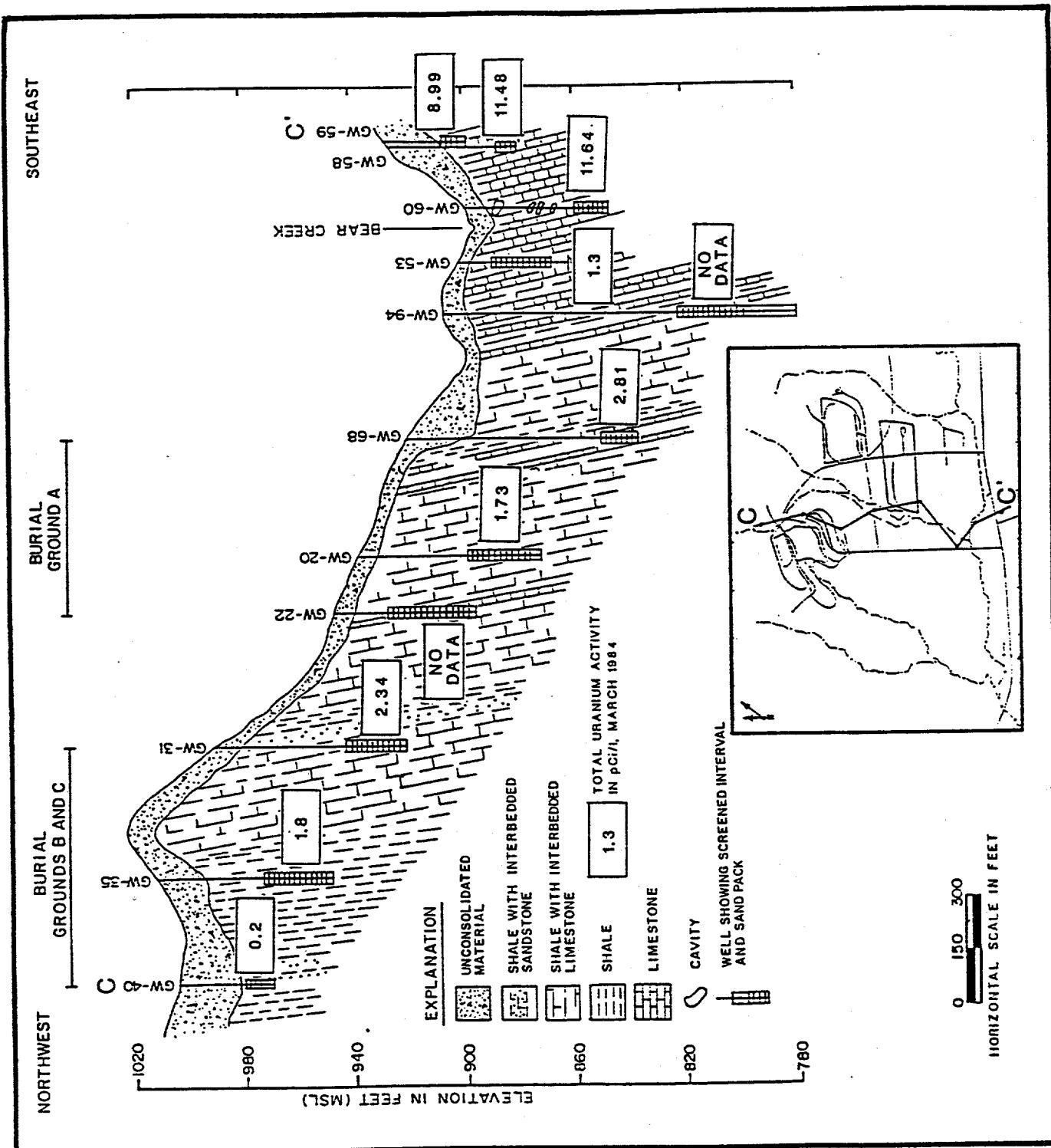


FIGURE 6. CROSS SECTION C-C' SHOWING TOTAL URANIUM ACTIVITY IN GROUND WATER AT THE BURIAL GROUNDS

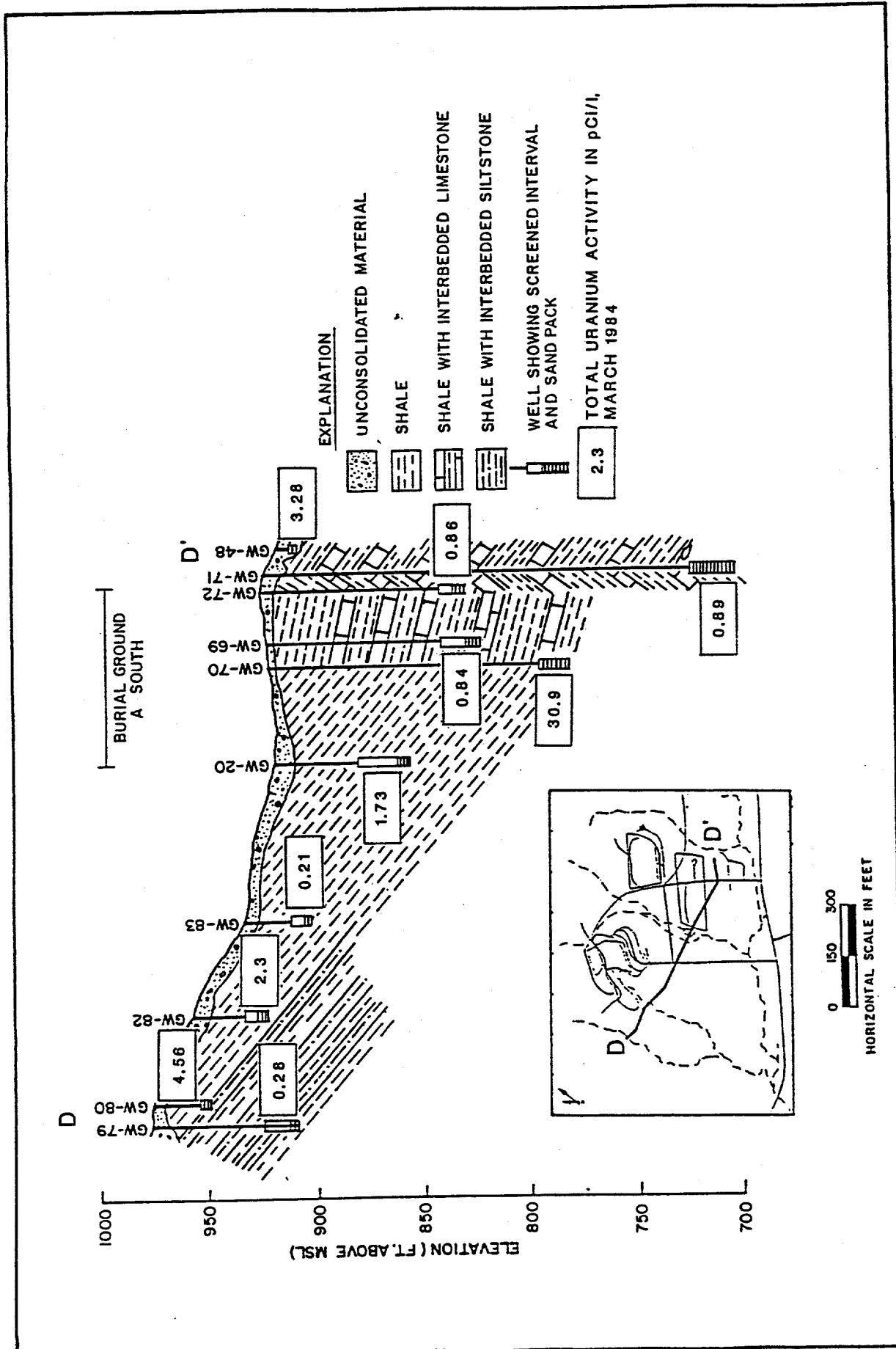


FIGURE 7. CROSS SECTION D-D' SHOWING TOTAL URANIUM ACTIVITY IN GROUND WATER AT THE BURIAL GROUNDS

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from these wells had uranium activity levels of 30.9, 0.89, and 1.19 pCi/l, respectively. The uranium activity level in GW-70 declined to less than 20 pCi/l in August 1984 (GW-71 and GW-77 were not sampled at that time).

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APPENDIX A

MONITOR-WELL NETWORKS IN THE
BEAR CREEK VALLEY WASTE DISPOSAL AREA

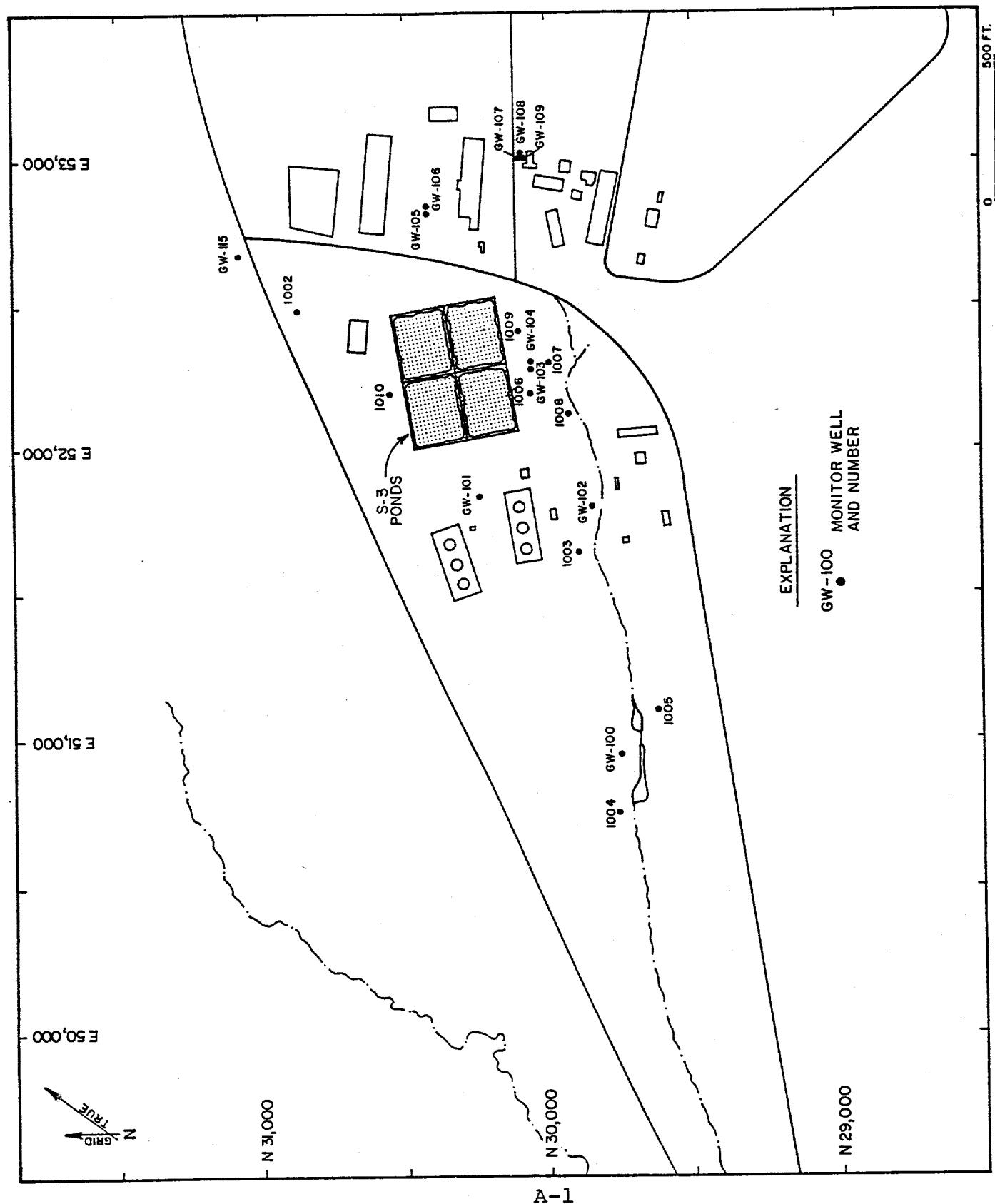


Figure A-1. MONITOR-WELL NETWORK AT THE S-3 PONDS.

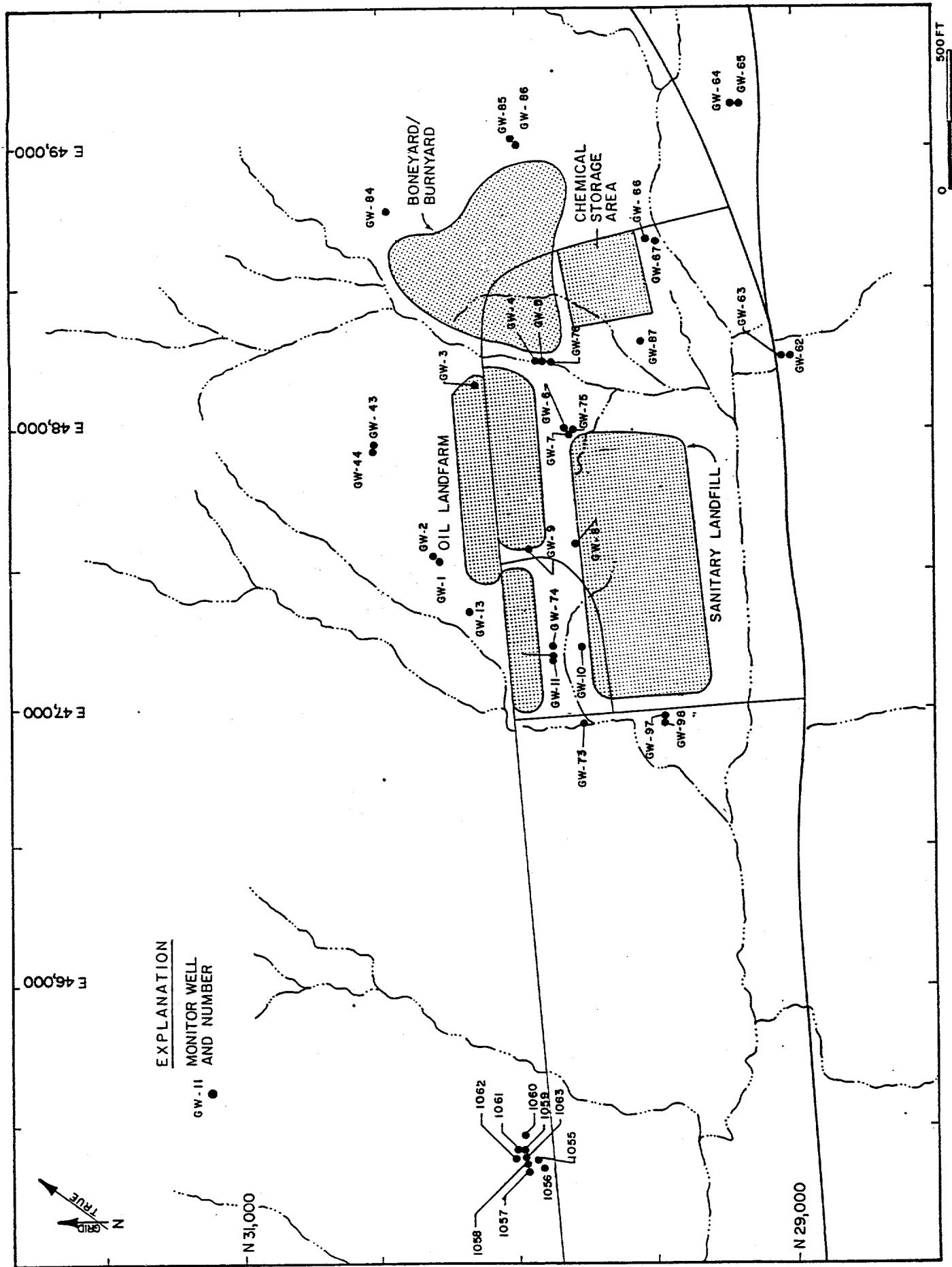


Figure A-2. MONITOR-WELL NETWORK AT THE OIL LANDFARM.

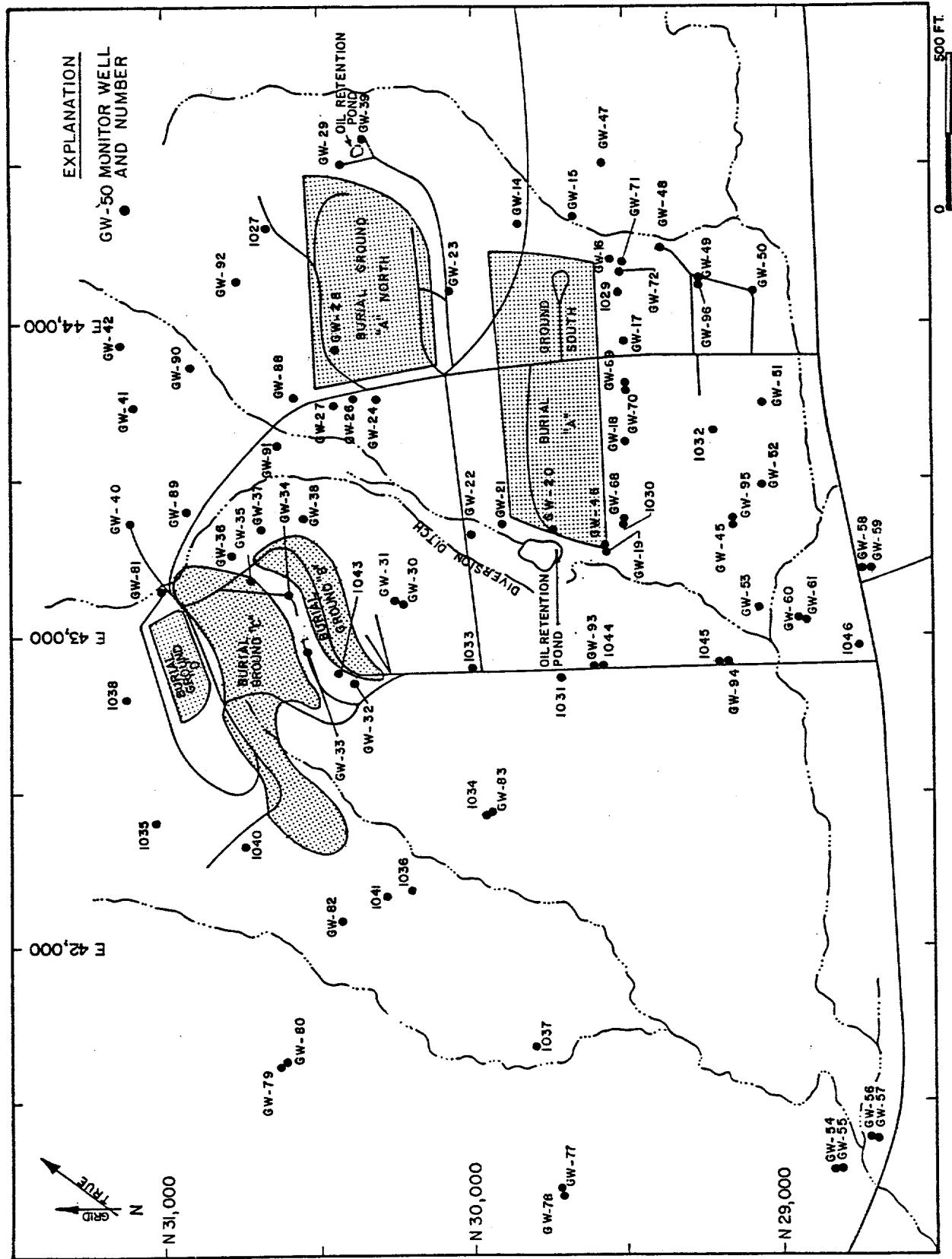


Figure A-3. MONITOR - WELL NETWORK AT THE BURIAL GROUNDS

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APPENDIX B

CONSTRUCTION DETAILS OF MONITOR WELLS IN
THE BEAR CREEK VALLEY WASTE DISPOSAL AREA

(from "Hydrologic Data on Bear Creek
Valley Watershed Area,"
Y/TS-110, June 21, 1985)

WELL NUMBER	GW-1	GW-2	GW-3	GW-4	GW-5
ZONE	F, W	F	F	F	U, W
SITE	O L F	O L F	O L F	O L F	O L F
NORTH COORDINATES	30297	30298	30151	29940	29931
EAST COORDINATES	47528	47528	48149	48236	48235
UNCONSOLID. MATERIAL	CL	ST, CL	CL	FL, CL	FL, CL
WEATH. ROCK MATERIAL	SH	SH	SH	SH, STs	SH, SD
WEATH. ROCK FORMATION	Cm	Cm	Cm	Cn	Cn
FRESH ROCK MATERIAL	SH, Ls	SH, Ls, SS	SH, Ls	SH, Ls	
FRESH ROCK FORMATION	Cm	Cm	Cm	Cn	
SAMPLE	SS, Core	Core	SS, Core	Core	SS
GROUND ELEVATION	978.70	979.20	970.70	962.60	962.40
MEASURING POINT ELEV.	981.00	982.60	973.20	NONE	965.10
MEASURING POINT	TOC	TOC	TOC	NONE	TOC
TOP WEATH ROCK -DEPTH	2.50	2.50	8.90	18.50	9.70
TOP FRESH ROCK -DEPTH	36.00	36.40	18.10	35.40	
BOTTOM OF HOLE -DEPTH	! 45.00	! 60.00	! 35.20	58.40	! 12.50
TOP WEATH ROCK -ELEV	976.20	976.70	961.80	944.10	952.70
TOP FRESH ROCK -ELEV	942.70	942.80	952.60	927.20	
BOTTOM OF HOLE -ELEV	933.70	919.20	935.50	904.20	949.90
TOP GRVL/SD PK -DEPTH	14.10	40.30	18.00	NONE	3.00
BTM GRVL/SD PK -DEPTH	25.70	60.00	! 28.00	NONE	12.50
TOP OF SCREEN -DEPTH	18.10	52.70	21.80	NONE	5.30
BTM OF SCREEN -DEPTH	! 23.10	! 57.70	! 26.80	NONE	! 10.30
TOP GRVL/SD PK -ELEV.	964.60	938.90	952.70	NONE	959.40
BTM GRVL/SD PK -ELEV.	953.00	919.20	942.70	NONE	949.90
TOP OF SCREEN -ELEV	960.60	926.50	948.90	NONE	957.10
BTM OF SCREEN -ELEV	955.60	921.50	943.90	NONE	952.10
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	NONE	SCREEN
SCREEN MATERIAL	St St	St St	St St	NONE	St St
SCREEN SLOT SIZE	0.01	0.01	0.01	NONE	0.01
CAP (MATERIAL)	BENTON	BENTON	BENTON	CEMENT	BENTON
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT	CEMENT	CEMENT
SUMP (Y/N, LENGTH)					
SURFACE CASING: RIG	AUGER	AUGER	AUGER	ROTARY	AUGER
HOLE DIAM., DEPTH	6/9	6/31.5	6/18.1	4.75/58	6/12.5
CASG DIAM., DEPTH		6/26.5		NONE	
WELL CASING: RIG	AUGER	AUGER	ROTARY	ROTARY	AUGER
HOLE DIAM., DEPTH	3/45	3/60	4.5/35.2	4.75/58	6/12.5
CASG DIAM., DEPTH	2/45	2/60	2/35.2		2/12.5
CASING MATERIAL	St St	St St	St St	NONE	St St
BEGUN (DATE)	02-Sep-83	22-Sep-83	13-Sep-83	08-Sep-83	22-Sep-83
COMPLETED (DATE)	08-Sep-83	30-Sep-83	19-Sep-83	14-Sep-83	22-Sep-83
DEVELOPED (DATE)	same	same	same	NO	same
WELL VOLUMES DEVELOP.	> 3.5	> 3.5	> 3.5	0	> 3.5
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL

WELL NUMBER	GW-6	GW-7	GW-8	GW-9	GW-10
ZONE	F, W	F, W	F, W	F	W
SITE	O L F	O. L F	O L F	O L F	O L F
NORTH COORDINATES	29818	29817	29787	29957	29764
EAST COORDINATES	47988	47974	47591	47565	47214
UNCONSOLID. MATERIAL	ST, CL	ST, CL	FL	FL	FL, CL
WEATH. ROCK MATERIAL	SH	SH	SH	SH, CL	SH,Ls,SD
WEATH. ROCK FORMATION	Cn	Cn	Cn	Cn	Cn
FRESH ROCK MATERIAL	SH, Ls			SH, Ls	
FRESH ROCK FORMATION	Cn			Cn	
SAMPLE	SS, Core		SS, Core	Core	SS
GROUND ELEVATION	959.90	960.30	962.10	960.70	950.10
MEASURING POINT ELEV.	962.70	963.50	964.80	NONE	952.70
MEASURING POINT	TOC	TOC	TOC	NONE	TOC
TOP WEATH ROCK -DEPTH	7.00	7.00	0.60	0.25	9.60
TOP FRESH ROCK -DEPTH	16.50			17.00	
BOTTOM OF HOLE -DEPTH	46.80	! 16.50	! 25.50	63.80	! 15.00
TOP WEATH ROCK -ELEV	952.90	953.30	961.50	960.45	940.50
TOP FRESH ROCK -ELEV	943.40	943.80	936.60	943.70	
BOTTOM OF HOLE -ELEV	913.10			896.90	935.10
TOP GRVL/SD PK -DEPTH	15.30	8.70	13.00	NONE	5.30
BTM GRVL/SD PK -DEPTH	46.80	16.50	25.50	NONE	15.00
TOP OF SCREEN -DEPTH	37.30	12.30	15.70	NONE	7.70
BTM OF SCREEN -DEPTH	! 42.30	! 14.30	! 20.70	NONE	! 12.70
TOP GRVL/SD PK -ELEV.	944.60	951.60	949.10	NONE	944.80
BTM GRVL/SD PK -ELEV.	913.10	943.80	936.60	NONE	935.10
TOP OF SCREEN -ELEV	922.60	948.00	946.40	NONE	942.40
BTM OF SCREEN -ELEV	917.60	949.20	941.40	NONE	937.40
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	NONE	SCREEN
SCREEN MATERIAL	St St	St St	St St	NONE	St St
SCREEN SLOT SIZE	0.01	0.01	0.01	NONE	0.01
CAP (MATERIAL)	BENTON	BENTON	BENTON	CEMENT	BENTON
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT	CEMENT	CEMENT
SUMP (Y/N, LENGTH)				NONE	
SURFACE CASING: RIG	AUGER	AUGER	AUGER	ROTARY	AUGER
HOLE DIAM., DEPTH	6/16.5	6/16.5	6/15	4.75/63	6/15
CASG DIAM., DEPTH				NONE	
WELL CASING: RIG	ROTARY	AUGER	ROTARY	ROTARY	AUGER
HOLE DIAM., DEPTH	4.5/46.8	6/16.5	4.5/25.5	4.75/63	6/15
CASG DIAM., DEPTH	2/46.8	2/16.5	2/25.5	NONE	2/15
CASING MATERIAL	St St	St St	St St		St St
BEGUN (DATE)	17-Sep-83	21-Sep-83	20-Sep-83	14-Sep-83	22-Sep-83
COMPLETED (DATE)	17-Sep-83	21-Sep-83	21-Sep-83	16-Sep-83	23-Sep-83
DEVELOPED (DATE)				NO	
WELL VOLUMES DEVELOP.	> 3.5	> 3.5	> 3.5	0	> 3.5
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL
		4-7			

WELL NUMBER	GW-11	GW-12	GW-13	GW-14	GW-15
ZONE	F, W	F, W	F, W	W	U, W
SITE	O L F	O L F	O L F	B G	B G
NORTH COORDINATES	29871	29871	30177	29848	29659
EAST COORDINATES	47164	47183	47334	44308	44331
UNCONSOLID. MATERIAL	FL, CL	FL, CL	ST, CL	Ovbdn	ST
WEATH. ROCK MATERIAL	SD, SH	SD, SH	SH, STs, SDs	SH	SH, SDs
WEATH. ROCK FORMATION	Cn	Cn	Cm	Cn	
FRESH ROCK MATERIAL	SH, Ls, SD		SH, Ls		
FRESH ROCK FORMATION	Cn		Cm		
SAMPLE	SS, Core	NONE	SS, Core	SS	SS
GROUND ELEVATION	948.90	949.50	962.30	931.50	922.00
MEASURING POINT ELEV.	953.00	953.50	964.50	933.90	925.60
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	6.50	6.50	5.30	4.00	5.10
TOP FRESH ROCK -DEPTH	34.50		10.50		
BOTTOM OF HOLE -DEPTH	! 60.80	! 15.50	! 33.80	! 13.20	! 7.90
TOP WEATH ROCK -ELEV	942.40	943.00	957.00	927.50	916.90
TOP FRESH ROCK -ELEV	914.40		951.80		
BOTTOM OF HOLE -ELEV	888.10	934.00	928.50	918.30	914.10
TOP GRVL/SD PK -DEPTH	28.00	8.70	6.00	5.00	1.00
BTM GRVL/SD PK -DEPTH	! 46.50	15.50	! 14.00	13.20	7.90
TOP OF SCREEN -DEPTH	40.30	11.50	8.40	10.00	1.70
BTM OF SCREEN -DEPTH	! 45.30	! 13.50	! 10.40	! 12.00	! 6.70
TOP GRVL/SD PK -ELEV.	920.90	940.80	956.30	926.50	921.00
BTM GRVL/SD PK -ELEV.	902.40	934.00	948.30	918.30	914.10
TOP OF SCREEN -ELEV	908.60	938.00	953.90	921.50	920.30
BTM OF SCREEN -ELEV	903.60	936.00	951.90	919.50	915.30
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St	St St	St St	St St	St St
SCREEN SLOT SIZE	0.01	0.01	0.01		
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT		
SUMP (Y/N, LENGTH)					
SURFACE CASING: RIG	AUGER	AUGER	AUGER	AUGER	
HOLE DIAM., DEPTH	6/17	6/15.5	6/33.8	6/	6/7.9
CASG DIAM., DEPTH	6/17				
WELL CASING: RIG	ROTARY	AUGER	AUGER	AUGER	
HOLE DIAM., DEPTH	4/60.8	6/15.5	6/33.8	6/13.2	6/7.9
CASG DIAM., DEPTH	2/60.8	2/15.5	2/14	2/13.2	2/7.9
CASING MATERIAL	St St	St St	St St	St St	St St
BEGUN (DATE)	22-Sep-83	28-Sep-83	09-Sep-83	29-Sep-83	05-Oct-83
COMPLETED (DATE)	28-Sep-83	28-Sep-83	13-Sep-83	29-Sep-83	05-Oct-83
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 3.5	> 3.5	> 3.5	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL
	4-8				

WELL NUMBER	GW-16	GW-17	GW-18	GW-19	GW-20
ZONE	U. W	F	W	F	F
SITE	B G	B G	B G	B G	B G
NORTH COORDINATES	29539	29499	29497	29569	29736
EAST COORDINATES	44194	43939	43615	43273	43332
UNCONSOLID. MATERIAL	FL, CL	SD, ST		CL	FL, CL
WEATH. ROCK MATERIAL	SH Cn	SH,SS,Ls Cn	SH,SDs Cn	SH,SDs Cn	SH Cn
WEATH. ROCK FORMATION					
FRESH ROCK MATERIAL		Ls, SH Cn		SH, Ls Cn	SH Cn
FRESH ROCK FORMATION					
SAMPLE	SS	SS,Core	SS	Core	SS,Core
GROUND ELEVATION	926.50	926.40	921.60	917.50	919.70
MEASURING POINT ELEV.	928.20	930.30	924.50	919.40	922.10
MEASURING POINT	TOC	TOC	TOC	NONE	TOC
TOP WEATH ROCK -DEPTH	7.70	4.00	0.00	6.00	7.00
TOP FRESH ROCK -DEPTH		29.00		25.10	35.50
BOTTOM OF HOLE -DEPTH	! 17.10	! 61.50	! 20.80	53.90	! 66.10
TOP WEATH ROCK -ELEV	918.80	922.40	921.60	911.50	912.70
TOP FRESH ROCK -ELEV		897.40		892.40	884.20
BOTTOM OF HOLE -ELEV	909.40	864.90	900.80	863.60	853.60
TOP GRVL/SD PK -DEPTH	6.50	35.60	12.00	NONE	37.00
BTM GRVL/SD PK -DEPTH	17.10	61.50	! 18.90	NONE	60.10
TOP OF SCREEN -DEPTH	13.90	54.20	15.70	NONE	55.90
BTM OF SCREEN -DEPTH	! 15.90	! 59.20	! 17.70	NONE	! 57.90
TOP GRVL/SD PK -ELEV.	920.00	890.80	909.60	NONE	882.70
BTM GRVL/SD PK -ELEV.	909.40	864.90	902.70	NONE	859.60
TOP OF SCREEN -ELEV	912.60	872.20	905.90	NONE	863.80
BTM OF SCREEN -ELEV	910.60	867.20	903.90	NONE	861.80
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	NONE	SCREEN
SCREEN MATERIAL	St St	St St	St St	NONE	St St
SCREEN SLOT SIZE				NONE	
CAP (MATERIAL)	BENTON	BENTON	BENTON	CEMENT	BENTON
MATERIAL ABOVE CAP				CEMENT	
SUMP (Y/N, LENGTH)		NO	YES/1.9		YES/6
SURFACE CASING: RIG	AUGER	AUGER	AUGER	ROTARY	AUGER
HOLE DIAM., DEPTH	6/17.1	6/22	6/20.8	3/53.9	6/33.8
CASG DIAM., DEPTH				CEMENTED	6/34
WELL CASING: RIG	AUGER	ROTARY	AUGER	ROTARY	ROTARY
HOLE DIAM., DEPTH	6/17.1	4/61.5	6/20.8	3/53.9	4/66.1
CASG DIAM., DEPTH	2/17.1	2/61.5	2/20.8	CEMENTED	2/66.1
CASING MATERIAL	St St	St St	St St		St St
BEGUN (DATE)	03-Oct-83	30-Sep-83	05-Oct-83	28-Sep-83	01-Oct-83
COMPLETED (DATE)	03-Oct-83	06-Oct-83	05-Oct-83	01-Oct-83	04-Oct-83
DEVELOPED (DATE)					NO
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	0	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL

WELL NUMBER	GW-21	GW-22	GW-23	GW-24	GW-25
ZONE	W	F	F	F	F
SITE	B G	B G	B G	B G	B G
NORTH COORDINATES	29902	30005	30075	30320	30318
EAST COORDINATES	43356	43327	44097	43757	43754
UNCONSOLID. MATERIAL	ST	SD	ST, CL	ST	
WEATH. ROCK MATERIAL	SH	SH	SH	SH, SD	SH, ST
WEATH. ROCK FORMATION	Cn	Cn	Cn	Cm	Cm
FRESH ROCK MATERIAL		SH, ST, Ls	SH	Ls, SH	SH, SDs
FRESH ROCK FORMATION		Cn	Cn	Cm	Cm
SAMPLE	SS	SS, Core	SS, Core	SS, Core	Core
GROUND ELEVATION	920.70	923.70	951.80	955.20	955.00
MEASURING POINT ELEV.	924.00	926.20	954.60	957.80	
MEASURING POINT	TOC	TOC	TOC	TOC	NONE
TOP WEATH ROCK -DEPTH	2.00	6.00	6.50	1.00	0.00
TOP FRESH ROCK -DEPTH		7.50	25.00	28.00	27.50
BOTTOM OF HOLE -DEPTH	! 15.00	! 52.40	! 55.00	! 75.70	54.30
TOP WEATH ROCK -ELEV	918.70	917.70	945.30	954.20	955.00
TOP FRESH ROCK -ELEV		916.20	926.80	927.20	927.50
BOTTOM OF HOLE -ELEV	905.70	871.30	896.80	879.50	900.70
TOP GRVL/SD PK -DEPTH	5.50	20.00	31.00	45.00	NONE
BTM GRVL/SD PK -DEPTH	14.20	52.40	53.50	75.70	NONE
TOP OF SCREEN -DEPTH	11.00	49.00	50.40	72.60	NONE
BTM OF SCREEN -DEPTH	! 13.00	! 51.40	! 52.40	! 74.60	NONE
TOP GRVL/SD PK -ELEV.	915.20	903.70	920.80	910.20	NONE
BTM GRVL/SD PK -ELEV.	906.50	871.30	898.30	879.50	NONE
TOP OF SCREEN -ELEV	909.70	874.70	901.40	882.60	NONE
BTM OF SCREEN -ELEV	907.70	872.30	899.40	880.60	NONE
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	NONE
SCREEN MATERIAL	St St	St St	St St	St St	NONE
SCREEN SLOT SIZE					NONE
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	CEMENT
MATERIAL ABOVE CAP					CEMENT
SUMP (Y/N, LENGTH)	YES/0.8	NO	YES/1.5	NO	
SURFACE CASING: RIG	AUGER	AUGER	AUGER	AUGER	ROTARY
HOLE DIAM., DEPTH	6/9	6/7.5	6/25	6/31	4.25/54
CASG DIAM., DEPTH		6/7.5		6/31	CEMENTED
WELL CASING: RIG	ROTARY	ROTARY	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	4.25/15	4/52.4	4/55	4/75.7	4.25/54
CASG DIAM., DEPTH	2/15	2/52.4	2/55	2/75.7	CEMENTED
CASING MATERIAL	St St	St St	St St	St St	
BEGUN (DATE)	06-Oct-83	07-Oct-83	07-Oct-83	10-Oct-83	20-Sep-83
COMPLETED (DATE)	06-Oct-83	10-Oct-83	11-Oct-83	13-Oct-83	26-Sep-83
DEVELOPED (DATE)					NO
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	0
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL
		4-10			

WELL NUMBER	GW-26	GW-27	GW-28	GW-29	GW-30
ZONE	W	W	W	W	W
SITE	B G	B G	B G	B G	B G
NORTH COORDINATES	30389	30454	30536	30431	30247
EAST COORDINATES	43756	43741	43899	44501	43110
UNCONSOLID. MATERIAL	FL, SH	FL	FL	ST	
WEATH. ROCK MATERIAL	SH	SH, SS	SH, STs	SH	SH, SS
WEATH. ROCK FORMATION	Cm	Cm	Cm	Cm	Cm
FRESH ROCK MATERIAL					SH, Ls
FRESH ROCK FORMATION					Cm
SAMPLE	SS	SS	SS	SS	NONE
GROUND ELEVATION	961.50	961.60	979.10	964.70	970.20
MEASURING POINT ELEV.	964.10	965.30	981.80	968.10	973.60
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	3.10	4.50	3.70	3.00	0.00
TOP FRESH ROCK -DEPTH					38.50
BOTTOM OF HOLE -DEPTH	! 20.20	! 30.50	! 21.40	! 22.40	! 40.00
TOP WEATH ROCK -ELEV	958.40	957.10	975.40	961.70	970.20
TOP FRESH ROCK -ELEV					931.70
BOTTOM OF HOLE -ELEV	941.30	931.10	957.70	942.30	930.20
TOP GRVL/SD PK -DEPTH	10.00	18.50	5.50	6.00	27.00
BTM GRVL/SD PK -DEPTH	20.20	30.50	21.40	21.10	39.00
TOP OF SCREEN -DEPTH	17.00	27.30	15.20	15.30	27.80
BTM OF SCREEN -DEPTH	! 19.00	! 29.30	! 20.20	! 17.30	! 37.80
TOP GRVL/SD PK -ELEV.	951.50	943.10	973.60	958.70	943.20
BTM GRVL/SD PK -ELEV.	941.30	931.10	957.70	943.60	931.20
TOP OF SCREEN -ELEV	944.50	934.30	963.90	949.40	942.40
BTM OF SCREEN -ELEV	942.50	932.30	958.90	947.40	932.40
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St				
SCREEN SLOT SIZE					
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP					
SUMP (Y/N, LENGTH)	NO	NO	NO	YES/1.3	YES/1
SURFACE CASING: RIG	AUGER	AUGER	AUGER	AUGER	AUGER
HOLE DIAM., DEPTH	6/20.2	6/20	6/17	6/16	6/40
CASG DIAM., DEPTH		6/20			
WELL CASING: RIG	AUGER	ROTARY	ROTARY	ROTARY	AUGER
HOLE DIAM., DEPTH	6/20.2	4/30.5	4.5/21.4	4.5/22.4	6/40
CASG DIAM., DEPTH	2/20.2	2/30.5	2/21.4	2/22.4	2/40
CASING MATERIAL	St St				
BEGUN (DATE)	17-Oct-83	11-Oct-83	14-Oct-83	11-Oct-83	21-Oct-83
COMPLETED (DATE)	17-Oct-83	12-Oct-83	14-Oct-83	11-Oct-83	21-Oct-83
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL
		4-11			

WELL NUMBER	GW-31	GW-32	GW-33	GW-34	GW-35
ZONE	F	F	F	W	F
SITE	B G	B G	B G	B G	B G
NORTH COORDINATES	30242	30394	30540	30601	30719
EAST COORDINATES	43109	42850	42946	43131	43178
UNCONSOLID. MATERIAL			CL	FL	
WEATH. ROCK MATERIAL	SH, SDs	SH, SDs	SH, SDs	SH	SH
WEATH. ROCK FORMATION	Cm	Cm	Cm	Cm	Cm
FRESH ROCK MATERIAL	SH, Ls	SH, Ls	SH, SDs		SH
FRESH ROCK FORMATION	Cm	Cm	Cm		Cm
SAMPLE	SS, Core	Core	SS	SS	SS, Core
GROUND ELEVATION	969.90	999.00	995.70	995.30	994.20
MEASURING POINT ELEV.	973.60	1001.10	997.30	998.10	996.50
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	0.00	0.00	1.00	1.40	0.00
TOP FRESH ROCK -DEPTH	38.50	28.60	31.00		17.00
BOTTOM OF HOLE -DEPTH	! 70.00	! 54.10	! 38.00	! 45.50	! 62.00
TOP WEATH ROCK -ELEV.	969.90	999.00	994.70	993.90	994.20
TOP FRESH ROCK -ELEV.	931.40	970.40	964.70		977.20
BOTTOM OF HOLE -ELEV	899.90	944.90	957.70	949.80	932.20
TOP GRVL/SD PK -DEPTH	47.00	26.00	30.00	27.00	37.50
BTM GRVL/SD PK -DEPTH	67.00	! 50.50	! 37.90	45.20	60.30
TOP OF SCREEN -DEPTH	63.70	45.10	34.70	34.00	49.10
BTM OF SCREEN -DEPTH	! 65.70	! 49.50	! 36.70	! 44.00	! 59.10
TOP GRVL/SD PK -ELEV.	922.90	973.00	965.70	968.30	956.70
BTM GRVL/SD PK -ELEV.	902.90	948.50	957.80	950.10	933.90
TOP OF SCREEN -ELEV	906.20	953.90	961.00	961.30	945.10
BTM OF SCREEN -ELEV	904.20	949.50	959.00	951.30	935.10
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St				
SCREEN SLOT SIZE					
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP					
SUMP (Y/N, LENGTH)	YES/3	YES/4.2	NO	YES/0.3	YES/1.7
SURFACE CASING: RIG	AUGER	ROTARY	AUGER	AUGER	AUGER
HOLE DIAM., DEPTH	6/17	4.25/6	6/38	6/27	6/22.5
CASG DIAM., DEPTH	6/17	4/5.8			
WELL CASING: RIG	ROTARY	ROTARY	AUGER	ROTARY	ROTARY
HOLE DIAM., DEPTH	4/70	3/54.1	6/38	4.5/45.5	4/62
CASG DIAM., DEPTH	2/70	2/54.1	2/38	2/45.5	2/62
CASING MATERIAL	St St				
BEGUN (DATE)	13-Oct-83	04-Oct-83	15-Oct-83	13-Oct-83	15-Oct-83
COMPLETED (DATE)	19-Oct-83	08-Oct-83	17-Oct-83	31-Oct-83	19-Oct-83
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL

WELL NUMBER	GW-36	GW-37	GW-38	GW-39	GW-40
ZONE	W	F	W	W	W
SITE	B G	B G	B G	B G	B G
NORTH COORDINATES	30787	30695	30543	30359	31116
EAST COORDINATES	43257	43342	43371	44584	43355
UNCONSOLID. MATERIAL	ST	ST	FL	ST	
WEATH. ROCK MATERIAL	SH, CL, SD	SH, SS	SH, SS	SH	SH, SS
WEATH. ROCK FORMATION	Crg	Crg	Cm	Cm	Cpv
FRESH ROCK MATERIAL		SH, SS, Ls			
FRESH ROCK FORMATION		Crg			
SAMPLE	SS	SS, Core	SS	SS	SS
GROUND ELEVATION	991.90	1002.30	1004.50	955.70	1003.80
MEASURING POINT ELEV.	995.30	1005.60	1007.20	958.40	1008.00
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	1.50	1.50	3.70	2.00	0.00
TOP FRESH ROCK -DEPTH		39.00			
BOTTOM OF HOLE -DEPTH	! 39.10	! 70.00	! 52.50	! 22.50	! 35.00
TOP WEATH ROCK -ELEV	990.40	1000.80	1000.80	953.70	1003.80
TOP FRESH ROCK -ELEV		963.30			
BOTTOM OF HOLE -ELEV	952.80	932.30	952.00	933.20	968.80
TOP GRVL/SD PK -DEPTH	8.50	42.00	38.90	6.00	21.00
BTM GRVL/SD PK -DEPTH	39.10	68.70	52.40	21.10	29.00
TOP OF SCREEN -DEPTH	34.90	64.50	41.20	17.90	25.70
BTM OF SCREEN -DEPTH	! 36.90	! 66.50	! 51.20	! 19.90	! 27.70
TOP GRVL/SD PK -ELEV.	983.40	960.30	965.60	949.70	982.80
BTM GRVL/SD PK -ELEV.	952.80	933.60	952.10	934.60	974.80
TOP OF SCREEN -ELEV	957.00	937.80	963.30	937.80	978.10
BTM OF SCREEN -ELEV	955.00	935.80	953.30	935.80	976.10
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St	St St	St St	St St	St St
SCREEN SLOT SIZE					
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP					
SUMP (Y/N, LENGTH)	NO	YES/1.3	NO	YES/1.4	YES/6
SURFACE CASING: RIG	AUGER	AUGER	AUGER	AUGER	AUGER
HOLE DIAM., DEPTH	6/39.1	6/22.5	6/52.5	6/22.5	6/35
CASG DIAM., DEPTH					
WELL CASING: RIG	AUGER	ROTARY	AUGER	AUGER	AUGER
HOLE DIAM., DEPTH	6/39.1	4/70	6/52.5	6/22.5	6/35
CASG DIAM., DEPTH	2/39.1	2/70	2/52.5	2/22.5	2/35
CASING MATERIAL	St St	St St	St St	St St	St St
BEGUN (DATE)	18-Oct-83	24-Oct-83	20-Oct-83	12-Oct-83	29-Sep-83
COMPLETED (DATE)	19-Oct-83	28-Oct-83	21-Oct-83	13-Oct-83	30-Sep-83
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL
	4-13				

WELL NUMBER	GW-41	GW-42	GW-43	GW-44	GW-45
ZONE	F, W	W	F, W	F	W
SITE	B G	B G	O L F	O L F	B G
NORTH COORDINATES	31100	31142	30528	30533	29146
EAST COORDINATES	43736	49935	47929	47917	43353
UNCONSOLID. MATERIAL	CL	ST	ST	ST	FL
WEATH. ROCK MATERIAL	SH, STs, SS	SH, SS Cpv	SH, SD, CL Cm	SH, SD, CL Cm	SH, CL Cmn
WEATH. ROCK FORMATION	Cpv				
FRESH ROCK MATERIAL	SH, STs	SH, LS Cpv	SH, LS Cm	SH, LS Cm	SH, LS Cmn
FRESH ROCK FORMATION	Cpv				
SAMPLE	SS, Core	SS	NONE	Core	SS
GROUND ELEVATION	1004.30	1000.00	1009.90	1010.40	907.40
MEASURING POINT ELEV.	1007.50	1003.30	1011.60	1013.60	909.70
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	2.20	3.50	1.00	1.00	9.00
TOP FRESH ROCK -DEPTH	25.00		38.00	38.00	
BOTTOM OF HOLE -DEPTH	! 40.00	! 30.00	! 40.00	! 70.00	! 15.20
TOP WEATH ROCK -ELEV	1002.10	996.50	1008.90	1009.40	898.40
TOP FRESH ROCK -ELEV	979.30		971.90	972.40	
BOTTOM OF HOLE -ELEV	964.30	970.00	969.90	940.40	892.20
TOP GRVL/SD PK -DEPTH	6.00	13.40	10.00	42.50	3.00
BTM GRVL/SD PK -DEPTH	40.00	28.20	40.00	70.00	15.20
TOP OF SCREEN -DEPTH	36.60	24.90	22.80	48.00	3.00
BTM OF SCREEN -DEPTH	! 38.60	! 26.90	! 32.80	! 58.00	! 13.00
TOP GRVL/SD PK -ELEV.	998.30	986.60	999.90	967.90	904.40
BTM GRVL/SD PK -ELEV.	964.30	971.80	969.90	940.40	892.20
TOP OF SCREEN -ELEV	967.70	975.10	987.10	962.40	904.40
BTM OF SCREEN -ELEV	965.70	973.10	977.10	952.40	894.40
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St	St St	St St	St St	St St
SCREEN SLOT SIZE					
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP					
SUMP (Y/N, LENGTH)	NO	YES/1.8			NO
SURFACE CASING: RIG	AUGER	AUGER	AUGER	AUGER	AUGER
HOLE DIAM., DEPTH	6/15	6/30	6/40	6/27	6/15.2
CASG DIAM., DEPTH					
WELL CASING: RIG	ROTARY	AUGER	AUGER	ROTARY	AUGER
HOLE DIAM., DEPTH	4.5/40	6/30	6/40	4/70	6/15.2
CASG DIAM., DEPTH	2/40	2/30	2/40	2/70	2/15.2
CASING MATERIAL	St St	St St	St St	St St	St St
BEGUN (DATE)	26-Sep-83	28-Sep-83	26-Oct-83	20-Oct-83	26-Oct-83
COMPLETED (DATE)	27-Sep-83	29-Sep-83	27-Oct-83	26-Oct-83	26-Oct-83
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL

WELL NUMBER	GW-46	GW-47	GW-48	GW-49	GW-50
ZONE	W	U, W	W	U, W	U, W
SITE	B G	. B G	B G	B G	B G
NORTH COORDINATES	29568	29614	29390	29249	29078
EAST COORDINATES	43279	44499	44236	44125	44097
UNCONSOLID. MATERIAL	FL, CL	CL	CL	ST	CL, ST
WEATH. ROCK MATERIAL	SH, SS Cn	SH, SS, STs Cn	SH Cmn	SH, Ls Cmn	
WEATH. ROCK FORMATION					
FRESH ROCK MATERIAL					
FRESH ROCK FORMATION					
SAMPLE	SS	SS	SS	SS	SS
GROUND ELEVATION	917.30	925.90	915.00	917.70	912.20
MEASURING POINT ELEV.	919.70	928.40	918.20	920.60	914.70
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	7.70	4.00	3.50	8.70	15.00
TOP FRESH ROCK -DEPTH					
BOTTOM OF HOLE -DEPTH	! 20.50	! 25.50	! 9.00	! 20.50	! 15.00
TOP WEATH ROCK -ELEV	909.60	921.90	911.50	909.00	897.20
TOP FRESH ROCK -ELEV					
BOTTOM OF HOLE -ELEV	896.80	900.40	906.00	897.20	897.20
TOP GRVL/SD PK -DEPTH	5.00	12.50	2.00	6.30	6.00
BTM GRVL/SD PK -DEPTH	! 20.30	25.50	! 8.70	20.20	14.20
TOP OF SCREEN -DEPTH	8.10	18.50	2.30	13.60	11.00
BTM OF SCREEN -DEPTH	! 18.10	! 23.50	! 7.30	! 18.60	! 13.00
TOP GRVL/SD PK -ELEV.	912.30	913.40	913.00	911.40	906.20
BTM GRVL/SD PK -ELEV.	897.00	900.40	906.30	897.50	898.00
TOP OF SCREEN -ELEV	909.20	907.40	912.70	904.10	901.20
BTM OF SCREEN -ELEV	899.20	902.40	907.70	899.10	899.20
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St	St St	St St	St St	St St
SCREEN SLOT SIZE					
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP					
SUMP (Y/N, LENGTH)	NO	NO	NO	YES/0.3	YES/0.8
SURFACE CASING: RIG	AUGER	AUGER	AUGER	AUGER	AUGER
HOLE DIAM., DEPTH	6/20.5	6/25.5	6/9	6/16.5	6/15
CASG DIAM., DEPTH					
WELL CASING: RIG	AUGER	AUGER	AUGER	ROTARY	AUGER
HOLE DIAM., DEPTH	6/20.5	6/25.5	6/9	4.5/20.5	6/15
CASG DIAM., DEPTH	2/20.5	2/25.5	2/9	2/20.5	2/15
CASING MATERIAL	St St	St St	St St	St St	St St
BEGUN (DATE)	27-Oct-83	31-Oct-83	31-Oct-83	01-Nov-83	28-Oct-83
COMPLETED (DATE)	27-Oct-83	01-Nov-83	31-Oct-83	02-Nov-83	28-Oct-83
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL
	4-15				

WELL NUMBER	GW-51	GW-52	GW-53	GW-54	GW-55
ZONE	U. W	U	W, F	F	F
SITE	B G	B G	B G	B G	B G
NORTH COORDINATES	29056	29052	29066	28823	28811
EAST COORDINATES	43740	43478	43086	41280	41283
UNCONSOLID. MATERIAL	ST	ST	ST	CL	CL
WEATH. ROCK MATERIAL			Ls, SH, SS		
WEATH. ROCK FORMATION			Cmn		
FRESH ROCK MATERIAL				Ls	Ls
FRESH ROCK FORMATION				Cmn	Cmn
SAMPLE	SS	SS	SS, Core	Core	Core
GROUND ELEVATION	906.60	903.40	900.50	890.00	889.60
MEASURING POINT ELEV.	910.20	905.70	902.80	893.50	892.70
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	11.20		4.00		
TOP FRESH ROCK -DEPTH				7.40	6.40
BOTTOM OF HOLE -DEPTH	11.20	! 19.50	! 39.70	! 40.00	! 20.60
TOP WEATH ROCK -ELEV	895.40		896.50		
TOP FRESH ROCK -ELEV	895.40	883.90	860.80	882.60	883.20
BOTTOM OF HOLE -ELEV				850.00	869.00
TOP GRVL/SD PK -DEPTH	2.00	4.00	11.40	31.10	15.50
BTM GRVL/SD PK -DEPTH	11.20	19.50	32.80	! 37.20	! 20.00
TOP OF SCREEN -DEPTH	4.60	13.30	26.60	35.20	18.00
BTM OF SCREEN -DEPTH	! 9.60	! 18.30	! 31.60	! 37.20	! 20.00
TOP GRVL/SD PK -ELEV.	904.60	899.40	889.10	858.90	874.10
BTM GRVL/SD PK -ELEV.	895.40	883.90	867.70	852.80	869.60
TOP OF SCREEN -ELEV	902.00	890.10	873.90	854.80	871.60
BTM OF SCREEN -ELEV	897.00	885.10	868.90	852.80	869.60
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St	St St	St St	St St	St St
SCREEN SLOT SIZE				0.01	0.01
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP				CEMENT	CEMENT
SUMP (Y/N, LENGTH)	NO	NO	YES/6.9	NO	NO
SURFACE CASING: RIG	AUGER	AUGER	AUGER	AUGER	ROTARY
HOLE DIAM., DEPTH	6/11.2	6/19.5	6/4	6.5/7.4	4/20.6
CASG DIAM., DEPTH			6/4		
WELL CASING: RIG	AUGER	AUGER	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	6/11.2	6/19.5	4/39.7	4/40	4/20.6
CASG DIAM., DEPTH	2/11.2	2/19.5	2/39.7	2/40	2/20.6
CASING MATERIAL	St St	St St	St St	St St	St St
BEGUN (DATE)	02-Nov-83	02-Nov-83	01-Nov-83	29-Feb-84	06-Mar-84
COMPLETED (DATE)	02-Nov-83	02-Nov-83	04-Nov-83	03-Mar-84	08-Mar-84
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 1
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL
	4-16				

WELL NUMBER	GW-56	GW-57	GW-58	GW-59	GW-60
ZONE	F	F	F	F	F
SITE	B G	B G	B G	B G	B G
NORTH COORDINATES	28708	28699	28714	28702	28927
EAST COORDINATES	41382	41379	43211	43215	43053
UNCONSOLID. MATERIAL	ST	ST	CL	CL	CL
WEATH. ROCK MATERIAL					
WEATH. ROCK FORMATION					
FRESH ROCK MATERIAL	Ls Cmn	Ls Cmn	Ls Cmn	Ls Cmn	Ls Cmn
FRESH ROCK FORMATION					
SAMPLE	Core	Core	Core	Core	Core
GROUND ELEVATION	886.80	887.10	910.00	910.00	900.80
MEASURING POINT ELEV.	890.90	889.60	913.30	912.70	904.60
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH					
TOP FRESH ROCK -DEPTH	6.40	3.40	20.80	16.80	7.00
BOTTOM OF HOLE -DEPTH	! 55.20	! 25.00	! 45.20	! 27.00	! 50.00
TOP WEATH ROCK -ELEV					
TOP FRESH ROCK -ELEV	880.40	883.70	889.20	893.20	893.80
BOTTOM OF HOLE -ELEV	831.60	862.10	864.80	883.00	850.80
TOP GRVL/SD PK -DEPTH	49.10	17.50	38.80	19.50	38.00
BTM GRVL/SD PK -DEPTH	! 53.20	! 22.80	! 45.00	! 24.70	! 49.80
TOP OF SCREEN -DEPTH	53.20	20.80	42.20	22.80	47.80
BTM OF SCREEN -DEPTH	55.20	! 22.80	! 44.20	! 24.80	! 49.80
TOP GRVL/SD PK -ELEV.	837.70	869.60	871.20	890.50	862.80
BTM GRVL/SD PK -ELEV.	831.60	864.30	865.80	885.20	851.00
TOP OF SCREEN -ELEV	833.60	866.30	867.80	887.20	853.00
BTM OF SCREEN -ELEV	831.60	864.30	865.80	885.20	851.00
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St				
SCREEN SLOT SIZE	0.01	0.01	0.01	0.01	0.01
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT	CEMENT	CEMENT
SUMP (Y/N, LENGTH)	NO	NO	NO	NO	NO
SURFACE CASING: RIG	AUGER	AUGER	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	6.5/6	6.5/3.4	4/45.2	4.75/27	4/50
CASG DIAM., DEPTH	4/32	4/14			
WELL CASING: RIG	ROTARY	ROTARY	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	4/55.2	4/25	4/45.2	4.75/27	4/50
CASG DIAM., DEPTH	2/55.2	2/25	2/45.2	2/27	2/50
CASING MATERIAL	St St				
BEGUN (DATE)	26-Mar-84	24-Mar-84	29-Feb-84	06-Mar-84	09-Mar-84
COMPLETED (DATE)	27-Mar-84	29-Mar-84	06-Mar-84	07-Mar-84	15-Mar-84
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL

WELL NUMBER	GW-61	GW-62	GW-63	GW-64	GW-65
ZONE	F	F	F	F	W, F
SITE	B G	O L F	O L F	O L F	O L F
NORTH COORDINATES	28916	29005	29016	29195	29185
EAST COORDINATES	43049	48258	48257	49169	49167
UNCONSOLID. MATERIAL	CL	CL	CL	CL	CL
WEATH. ROCK MATERIAL					
WEATH. ROCK FORMATION					
FRESH ROCK MATERIAL	Ls Cmn	Ls, SH Cmn	Ls, SH Cmn	Ls, SH Cmn	Ls Cmn
FRESH ROCK FORMATION					
SAMPLE	Core	Core	Core	Core	Core
GROUND ELEVATION	901.00	959.80	959.00	979.30	979.70
MEASURING POINT ELEV.	904.60	962.40	962.10	981.70	982.50
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH					
TOP FRESH ROCK -DEPTH	15.70	20.10	16.70	34.70	30.10
BOTTOM OF HOLE -DEPTH	25.00	56.70	35.00	57.00	35.00
TOP WEATH ROCK -ELEV					
TOP FRESH ROCK -ELEV	885.30	939.70	942.30	944.60	949.60
BOTTOM OF HOLE -ELEV	876.00	903.10	924.00	922.30	944.70
TOP GRVL/SD PK -DEPTH	17.50	45.10	27.70	46.80	29.00
BTM GRVL/SD PK -DEPTH	24.60	51.40	32.70	52.70	34.00
TOP OF SCREEN -DEPTH	19.60	49.40	27.70	50.70	29.00
BTM OF SCREEN -DEPTH	24.60	51.40	32.70	52.70	34.00
TOP GRVL/SD PK -ELEV.	883.50	914.70	931.30	932.50	950.70
BTM GRVL/SD PK -ELEV.	876.40	908.40	926.30	926.60	945.70
TOP OF SCREEN -ELEV	881.40	910.40	931.30	928.60	950.70
BTM OF SCREEN -ELEV	876.40	908.40	926.30	926.60	945.70
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St	St St	St St	St St	St St
SCREEN SLOT SIZE	0.01	0.01	0.01	0.01	0.01
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT	CEMENT	CEMENT
SUMP (Y/N, LENGTH)	NO	NO	NO	NO	NO
SURFACE CASING: RIG	ROTARY	AUGER	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	4.75/25	6/20.1	4.75/16	4.75/34	4.75/30
CASG DIAM., DEPTH					
WELL CASING: RIG	ROTARY	ROTARY	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	4.75/25	5/56.7	4/35	4/57	4/35
CASG DIAM., DEPTH	2/25	2/56.7	2/35	2/57	2/35
CASING MATERIAL	St St	St St	St St	St St	St St
BEGUN (DATE)	21-Mar-84	09-Mar-84	14-Mar-84	09-Mar-84	13-Mar-84
COMPLETED (DATE)	21-Mar-84	13-Mar-84	15-Mar-84	12-Mar-84	14-Mar-84
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL

WELL NUMBER	GW-66	GW-67	GW-68	GW-69	GW-70
ZONE	F	U	F	F	F
SITE	O L F	O L F	B G	B G	B G
NORTH COORDINATES	29513	29504	29500	29489	29491
EAST COORDINATES	48677	48679	43377	43802	43787
UNCONSOLID. MATERIAL	ST, FL	ST, FL		CL	CL
WEATH. ROCK MATERIAL			SH	SH	SH
WEATH. ROCK FORMATION			Cn	Cn	Cn
FRESH ROCK MATERIAL	Ls, SH		SH, Ls	SH, Ls	SH, Ls
FRESH ROCK FORMATION	Cmn		Cn	Cn	Cn
SAMPLE	Core				
GROUND ELEVATION	957.30	957.10	921.20	924.20	924.00
MEASURING POINT ELEV.	961.90	961.60	924.00	927.00	926.40
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	-		0.00	3.00	2.00
TOP FRESH ROCK -DEPTH	16.20		25.00	24.00	22.00
BOTTOM OF HOLE -DEPTH	55.80	! 16.50	! 85.00	99.20	140.50
TOP WEATH ROCK -ELEV	957.30		921.20	921.20	922.00
TOP FRESH ROCK -ELEV	941.10		896.20	900.20	902.00
BOTTOM OF HOLE -ELEV	901.50	940.60	836.20	825.00	783.50
TOP GRVL/SD PK -DEPTH	50.00	7.60	70.00	79.00	121.00
BTM GRVL/SD PK -DEPTH	! 54.90	! 16.20	! 83.60	99.20	140.50
TOP OF SCREEN -DEPTH	52.90	11.20	71.90	89.00	124.90
BTM OF SCREEN -DEPTH	! 54.90	! 16.20	! 82.10	99.20	140.50
TOP GRVL/SD PK -ELEV.	907.30	949.50	851.20	845.20	803.00
BTM GRVL/SD PK -ELEV.	902.40	940.90	837.90	825.00	783.50
TOP OF SCREEN -ELEV	904.40	945.90	849.30	835.20	799.10
BTM OF SCREEN -ELEV	902.40	940.90	839.10	825.00	783.50
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St				
SCREEN SLOT SIZE	0.01	0.01	0.01	0.01	0.01
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT	CEMENT	CEMENT
SUMP (Y/N, LENGTH)	NO	NO	YES/1	NO	NO
SURFACE CASING: RIG	AUGER	AUGER	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	4/16.2	6.5/16.5	11.25/20	11.25/22	8.75/148
CASG DIAM., DEPTH				10/19	
WELL CASING: RIG	ROTARY	AUGER	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	4/55.8	6.5/16.5	8.75/85	7.88/100	8.75/148
CASG DIAM., DEPTH	2/55.8	2/16.5	2/85	2/99.2	2/140.5
CASING MATERIAL	St St				
BEGUN (DATE)	22-Mar-84	24-Mar-84	22-Mar-84	26-Mar-84	22-Mar-84
COMPLETED (DATE)	24-Mar-84	24-Mar-84	22-Mar-84	26-Mar-84	24-Mar-84
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL

WELL NUMBER	GW-71	GW-72	GW-73	GW-74	GW-75
ZONE	F	F	F	F	F
SITE	B G	B G	O L F	O L F	O L F
NORTH COORDINATES	29495	29502	29753	29870	29795
EAST COORDINATES	44191	44159	46940	47228	47988
UNCONSOLID. MATERIAL	ST	CL	FL, CL	CL	CL
WEATH. ROCK MATERIAL	SH	SH	SH	SH	SH
WEATH. ROCK FORMATION	Cn	Cn	Cn	Cn	Cn
FRESH ROCK MATERIAL	SH, Ls				
FRESH ROCK FORMATION	Cn	Cn	Cn	Cn	Cn
SAMPLE					
GROUND ELEVATION	925.40	926.30	948.40	950.90	960.40
MEASURING POINT ELEV.	928.30	929.90	951.10	954.30	965.00
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	5.50	5.00	6.00	1.00	6.00
TOP FRESH ROCK -DEPTH	16.00	34.00	36.00	46.00	14.00
BOTTOM OF HOLE -DEPTH!	220.60	101.40	81.00	202.00	200.00
TOP WEATH ROCK -ELEV	919.90	921.30	942.40	949.90	954.40
TOP FRESH ROCK -ELEV	909.40	892.30	912.40	904.90	946.40
BOTTOM OF HOLE -ELEV	704.80	824.90	867.40	748.90	760.40
TOP GRVL/SD PK -DEPTH	195.10	84.50	66.90	176.50	176.50
BTM GRVL/SD PK -DEPTH!	219.00	! 98.40	! 79.80	! 200.60	! 199.60
TOP OF SCREEN -DEPTH	198.40	87.80	69.80	180.00	179.60
BTM OF SCREEN -DEPTH !	219.00	! 98.40	! 79.80	! 200.60	! 199.60
TOP GRVL/SD PK -ELEV.	730.30	841.80	881.50	774.40	783.90
BTM GRVL/SD PK -ELEV.	706.40	829.90	868.60	750.30	760.80
TOP OF SCREEN -ELEV	727.00	838.50	878.60	770.90	780.80
BTM OF SCREEN -ELEV	706.40	827.90	868.60	750.30	760.80
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St				
SCREEN SLOT SIZE	0.01	0.01	0.01	0.01	0.01
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT	CEMENT	CEMENT
SUMP (Y/N, LENGTH)	NO	NO	NO	NO	NO
SURFACE CASING: RIG	ROTARY	ROTARY	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	11.75/16	11.25/19	11.25/15	11.25/20	11.25/16
CASG DIAM., DEPTH	10/16	10/13.2	10/13	10/19	10/16
WELL CASING: RIG	ROTARY	ROTARY	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	8.75/220	8.75/101	8.75/81	7.88/202	8.75/200
CASG DIAM., DEPTH	2/220	2/101	2/81	2/202	2/200
CASING MATERIAL	St St				
BEGUN (DATE)	24-Mar-84	29-Mar-84	28-Mar-84	27-Mar-84	30-Mar-84
COMPLETED (DATE)	25-Mar-84	30-Mar-84	29-Mar-84	27-Mar-84	31-Mar-84
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL

WELL NUMBER	GW-76	GW-77	GW-78	GW-79	GW-80
ZONE	F	F	F	F	W, F
SITE	O L F	B G	B G	B G	B G
NORTH COORDINATES	29909	29729	29730	30630	30622
EAST COORDINATES	48238	41234	41209	41616	41621
UNCONSOLID. MATERIAL	FL, CL	CL	CL	CL	CL
WEATH. ROCK MATERIAL	SH	SH	SH	SH	SH
WEATH. ROCK FORMATION	Cn	Cn	Cn	Crg	Crg
FRESH ROCK MATERIAL	SH, Ls	SH, STs, Ls	SH, STs, Ls	SH, STs	SH, STs
FRESH ROCK FORMATION	Cn	Cn	Cn	Crg	Crg
SAMPLE		Core			
GROUND ELEVATION	962.70	914.70	914.50	977.20	977.10
MEASURING POINT ELEV.	966.10	918.70	917.50	980.60	980.40
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	12.00	7.00	6.50	4.00	3.50
TOP FRESH ROCK -DEPTH	48.00	13.00	8.50	26.50	23.50
BOTTOM OF HOLE -DEPTH	81.00	100.50	21.10	65.00	30.00
TOP WEATH ROCK -ELEV	950.70	907.70	908.00	973.20	973.60
TOP FRESH ROCK -ELEV	914.70	901.70	906.00	950.70	953.60
BOTTOM OF HOLE -ELEV	881.70	814.20	893.40	912.20	947.10
TOP GRVL/SD PK -DEPTH	67.80	87.40	11.70	49.90	20.80
BTM GRVL/SD PK -DEPTH	80.30	100.30	21.10	64.90	29.70
TOP OF SCREEN -DEPTH	69.70	90.30	16.10	59.90	24.70
BTM OF SCREEN -DEPTH	80.30	100.30	21.10	64.90	29.70
TOP GRVL/SD PK -ELEV.	894.90	827.30	902.80	927.30	956.30
BTM GRVL/SD PK -ELEV.	882.40	814.40	893.40	912.30	947.40
TOP OF SCREEN -ELEV	893.00	824.40	898.40	917.30	952.40
BTM OF SCREEN -ELEV	882.40	814.40	893.40	912.30	947.40
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St	St St	St St	St St	St St
SCREEN SLOT SIZE	0.01	0.01	0.01	0.01	0.01
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT	CEMENT	CEMENT
SUMP (Y/N, LENGTH)	NO	NO	NO	NO	NO
SURFACE CASING: RIG	ROTARY	AUGER	AUGER	AUGER	AUGER
HOLE DIAM., DEPTH	11.25/20	6.5/12	6.5/21.1	6.5/65	6.5/30
CASG DIAM., DEPTH	10/19	4/35			
WELL CASING: RIG	ROTARY	ROTARY	AUGER	AUGER	AUGER
HOLE DIAM., DEPTH	8.75/81	3.88/100	6.5/21.1	6.5/65	6.5/30
CASG DIAM., DEPTH	2/81	2/100	2/21.1	2/65	2/30
CASING MATERIAL	St St	St St	St St	St St	St St
BEGUN (DATE)	28-Mar-84	26-Mar-84	30-Mar-84	23-Mar-84	24-Mar-84
COMPLETED (DATE)	28-Mar-84	29-Mar-84	30-Mar-84	23-Mar-84	24-Mar-84
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL
	4-21				

WELL NUMBER	GW-81	GW-82	GW-83	GW-84	GW-85
ZONE	W	F	F	W	F
SITE	B G	B G	B G	O L F	O L F
NORTH COORDINATES	31001	30432	29944	30456	30003
EAST COORDINATES	43144	42090	42436	48769	49058
UNCONSOLID. MATERIAL	CL	CL	CL	CL	ST
WEATH. ROCK MATERIAL	SH, SS	SH	SH	SH	SH, ST
WEATH. ROCK FORMATION	Cpv	Cm	Cn	Cm	Cn
FRESH ROCK MATERIAL		SH	SH		SH, LS, DL
FRESH ROCK FORMATION		Cm	Cn		Cn
SAMPLE			Core		Core
GROUND ELEVATION	976.80	959.40	934.30	993.70	979.80
MEASURING POINT ELEV.	979.00	962.50	938.00	996.60	982.90
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	6.50	7.00	4.00	4.00	2.00
TOP FRESH ROCK -DEPTH		23.00	13.70		40.00
BOTTOM OF HOLE -DEPTH	18.80	! 35.00	! 30.00	! 34.00	! 62.00
TOP WEATH ROCK -ELEV	970.30	952.40	930.30	989.70	977.80
TOP FRESH ROCK -ELEV		936.40	920.60		939.80
BOTTOM OF HOLE -ELEV	958.00	924.40	904.30	959.70	917.80
TOP GRVL/SD PK -DEPTH	13.70	29.40	19.90	18.50	48.40
BTM GRVL/SD PK -DEPTH	18.70	! 34.40	! 29.50	! 27.80	! 58.80
TOP OF SCREEN -DEPTH	13.70	29.40	24.50	22.80	53.80
BTM OF SCREEN -DEPTH	18.70	! 34.40	! 29.50	! 27.80	! 58.80
TOP GRVL/SD PK -ELEV.	963.10	930.00	914.40	975.20	931.40
BTM GRVL/SD PK -ELEV.	958.10	925.00	904.80	965.90	921.00
TOP OF SCREEN -ELEV	963.10	930.00	909.80	970.90	926.00
BTM OF SCREEN -ELEV	958.10	925.00	904.80	965.90	921.00
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St				
SCREEN SLOT SIZE	0.01	0.01	0.01	0.01	0.01
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT	CEMENT	CEMENT
SUMP (Y/N, LENGTH)	NO	NO	NO	NO	NO
SURFACE CASING: RIG	AUGER	AUGER	ROTARY	AUGER	AUGER
HOLE DIAM., DEPTH	6/18.8	6/25	4.75/30	6.5/34	6.5/40
CASG DIAM., DEPTH		6/25			
WELL CASING: RIG	AUGER	ROTARY	ROTARY	AUGER	ROTARY
HOLE DIAM., DEPTH	6/18.8	4/35	4.75/30	6.5/34	4/62
CASG DIAM., DEPTH	2/18.8	2/35	2/30	2/34	2/62
CASING MATERIAL	St St				
BEGUN (DATE)	16-Mar-84	17-Mar-84	16-Mar-84	16-Mar-84	19-Mar-84
COMPLETED (DATE)	16-Mar-84	17-Mar-84	16-Mar-84	17-Mar-84	22-Mar-84
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4	> 4	> 4	> 4
INSTALLED BY	BECHTEL	BECHTEL	BECHTEL	BECHTEL	BECHTEL

WELL NUMBER	GW-86	GW-87	GW-88	GW-89	GW-90
ZONE	W	W. F			
SITE	O L F	O L F	B G	B G	B G
NORTH COORDINATES	29994	29534	30578	30924	30906
EAST COORDINATES	49044	48313	43768	43405	43867
UNCONSOLID. MATERIAL	CL	FL, CL	SH	SH	CL
WEATH. ROCK MATERIAL	SH, CL				
WEATH. ROCK FORMATION	Cn				
FRESH ROCK MATERIAL					
FRESH ROCK FORMATION					
SAMPLE			NONE	NONE	NONE
GROUND ELEVATION	979.50	957.30	956.66	961.61	959.23
MEASURING POINT ELEV.	982.80	960.60	959.47	964.41	961.94
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	8.00	19.00	21.5	16.5	9
TOP FRESH ROCK -DEPTH			22.33	20	
BOTTOM OF HOLE -DEPTH	33.50	19.00	30	25	15
TOP WEATH ROCK -ELEV	971.50	938.30	935.16	945.11	950.23
TOP FRESH ROCK -ELEV			934.33	941.61	
BOTTOM OF HOLE -ELEV	946.00	938.30	926.66	936.61	944.23
TOP GRVL/SD PK -DEPTH	21.00	7.50	23	18	11
BTM GRVL/SD PK -DEPTH	29.60	19.00	30	25	15
TOP OF SCREEN -DEPTH	24.60	9.00	24	19	12
BTM OF SCREEN -DEPTH	29.60	19.00	29	24	14
TOP GRVL/SD PK -ELEV.	958.50	949.80	933.66	943.61	948.23
BTM GRVL/SD PK -ELEV.	949.90	938.30	926.66	936.61	944.23
TOP OF SCREEN -ELEV	954.90	948.30	932.66	942.61	947.23
BTM OF SCREEN -ELEV	949.90	938.30	927.66	937.61	945.23
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St				
SCREEN SLOT SIZE	0.01	0.01	0.01	0.01	0.01
CAP (MATERIAL)	BENTON	BENTON	BENTON	BENTON	BENTON
MATERIAL ABOVE CAP	CEMENT	CEMENT	GROUT	GROUT	GROUT
SUMP (Y/N, LENGTH)	NO	NO	Y/1	Y/1	Y/1
SURFACE CASING: RIG	AUGER	AUGER	AUGER	AUGER	AUGER
HOLE DIAM., DEPTH	4/33.5	6.5/19	4/	4/	4/
CASG DIAM., DEPTH					
WELL CASING: RIG	AUGER	AUGER	RB	RB	AUGER
HOLE DIAM., DEPTH	4/33.5	6.5/19	4/30	4/25	6.5/15
CASG DIAM., DEPTH	2/33.5	2/19	2/30	2/25	2/15
CASING MATERIAL	St St				
BEGUN (DATE)	22-Mar-84	23-Mar-84	10-May-85	14-May-85	16-May-85
COMPLETED (DATE)	22-Mar-84	23-Mar-84	10-May-85	15-May-85	16-May-85
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.	> 4	> 4			
INSTALLED BY	BECHTEL	BECHTEL	GEOTEK	GEOTEK	GEOTEK
	4-23				

WELL NUMBER	GW-91	GW-92	GW-93	GW-94	GW-95
ZONE			W	F	F
SITE	B G	B G	B G	B G	B G
NORTH COORDINATES	30633	30762	29597.00	29167.00	29142.00
EAST COORDINATES	43613	44139	42904.00	42912.00	43364.00
UNCONSOLID. MATERIAL	CL.SH	CL.SH	CL, SH	CL	SD,ST,CL
WEATH. ROCK MATERIAL			SH, CL	SH	SH
WEATH. ROCK FORMATION					
FRESH ROCK MATERIAL				SH, LS	SH, LS
FRESH ROCK FORMATION					
SAMPLE	NONE	NONE	NONE	Cut	Cut
GROUND ELEVATION	950.67	984.67	941.10	909.40	908.20
MEASURING POINT ELEV.	953.48	987.77	943.70	913.30	911.30
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	6.71	4	14.00	2.00	15.00
TOP FRESH ROCK -DEPTH		14		10.00	24.00
BOTTOM OF HOLE -DEPTH	25	25	49.00	115.30	156.00
TOP WEATH ROCK -ELEV	943.96	980.67	927.10	907.40	893.20
TOP FRESH ROCK -ELEV		970.67		899.40	884.20
BOTTOM OF HOLE -ELEV	925.67	959.67	892.10	794.10	752.20
TOP GRVL/SD PK -DEPTH	18	18	39.50	86.40	130.20
BTM GRVL/SD PK -DEPTH	25	25	49.00	115.30	156.00
TOP OF SCREEN -DEPTH	19	19	42.00	93.80	134.80
BTM OF SCREEN -DEPTH	24	24	47.00	114.80	155.80
TOP GRVL/SD PK -ELEV.	932.67	966.67	901.60	823.00	778.00
BTM GRVL/SD PK -ELEV.	925.67	959.67	892.10	794.10	752.20
TOP OF SCREEN -ELEV	931.67	965.67	899.10	815.60	773.40
BTM OF SCREEN -ELEV	926.67	960.67	894.10	794.60	752.40
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	St St				
SCREEN SLOT SIZE	0.01	0.01	0.01	0.01	0.01
CAP (MATERIAL)	BENTON	BENTON	SAND	SAND	SAND
MATERIAL ABOVE CAP	GROUT	GROUT	CEMENT	CEMENT	CEMENT
SUMP (Y/N, LENGTH)	Y/1	Y/1	Y/1.2	NO	NO
SURFACE CASING: RIG	AUGER	AUGER	AUGER	ROTARY	ROTARY
HOLE DIAM., DEPTH	4/	4/	6.5/49	16/19	16/15
CASG DIAM., DEPTH			2/48.2	10/19	10/15
WELL CASING: RIG	RB	RB	AUGER	ROTARY	ROTARY
HOLE DIAM., DEPTH	4/25	4/25	6.5/49	9/131	9/156
CASG DIAM., DEPTH	2/25	2/25	2/48.2	4/114.8	4/155.8
CASING MATERIAL	St St				
BEGUN (DATE)	17-May-85	21-May-85	11-Sep-84	19-Sep-84	19-Sep-84
COMPLETED (DATE)	17-May-85	21-May-85	11-Sep-84	19-Sep-84	19-Sep-84
DEVELOPED (DATE)			17-Oct-84	18-Oct-84	19-Oct-84
WELL VOLUMES DEVELOP.			6	10.9	9.5
INSTALLED BY	GEOTEK	GEOTEK	BECHTEL	BECHTEL	BECHTEL

WELL NUMBER	GW-96	GW-97	GW-98	GW-99	GW-100
OTHER NUMBER					
ZONE	F	W	F		W
SITE	B G	O L F	O L F		S-3
NORTH COORDINATES	29249.00	29459.00	29452.00	N	29759.00
EAST COORDINATES	44123.00	46959.00	46959.00	O	50957.00
UNCONSOLID. MATERIAL	CL	CL	CL	I	FL. CL
WEATH. ROCK MATERIAL	SH	Ls, SH	SH, Ls	N	SH
WEATH. ROCK FORMATION				S	Cmn
FRESH ROCK MATERIAL	SH, Ls		SH, Ls	A	Ls
FRESH ROCK FORMATION				L	Cmn
SAMPLE	Cut	NONE	Cut.	E	SS
GROUND ELEVATION	919.00	941.90	942.40		984.60
MEASURING POINT ELEV.	921.20	944.70	945.70	Y	986.75
MEASURING POINT	TOC	TOC	TOC	E	TOC
TOP WEATH ROCK -DEPTH	7.00	8.50	1.00		14.80
TOP FRESH ROCK -DEPTH	14.00		21.00		20.70
BOTTOM OF HOLE -DEPTH	61.00	19.20	104.00	T	20.70
TOP WEATH ROCK -ELEV	912.00	933.40	941.40		969.80
TOP FRESH ROCK -ELEV	905.00		921.40		963.90
BOTTOM OF HOLE -ELEV	858.00	922.70	838.40		963.90
TOP GRVL/SD PK -DEPTH	42.20	9.30	76.60		3.80
BTM GRVL/SD PK -DEPTH	61.00	19.20	104.00		20.70
TOP OF SCREEN -DEPTH	44.00	11.80	82.40		10.20
BTM OF SCREEN -DEPTH	59.40	16.80	103.40		14.20
TOP GRVL/SD PK -ELEV.	876.80	932.60	865.80		980.80
BTM GRVL/SD PK -ELEV.	858.00	922.70	838.40		963.90
TOP OF SCREEN -ELEV	875.00	930.10	860.00		974.40
BTM OF SCREEN -ELEV	859.60	925.10	839.00		970.40
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN		SCREEN
SCREEN MATERIAL	St St	St St	St St		PVC
SCREEN SLOT SIZE	0.01	0.01	0.01		0.01
CAP (MATERIAL)	SAND	SAND	SAND		SAND
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT		CEMENT
SUMP (Y/N, LENGTH)	Y/1.2	Y/1.2	NO		YES/0.9
SURFACE CASING: RIG	ROTARY	AUGER	ROTARY		AUGER
HOLE DIAM.. DEPTH	9/61	6.5/19.2	16/20		6.5/20.7
CASG DIAM., DEPTH	2/61	2/18	10/20		2/15.1
WELL CASING: RIG	ROTARY	AUGER	ROTARY		AUGER
HOLE DIAM.. DEPTH	9/61	6.5/19.2	9/104		6.5/20.7
CASG DIAM.. DEPTH	2/60.6	2/18	4/103.4		2/15.1
CASING MATERIAL	St St	St St	St St		PVC
BEGUN (DATE)	12-Sep-84	11-Sep-84	20-Sep-84		12-Sep-84
COMPLETED (DATE)	12-Sep-84	11-Sep-84	21-Sep-84		12-Sep-84
DEVELOPED (DATE)	17-Oct-84	18-Oct-84	18-Oct-84		18-Oct-84
WELL VOLUMES DEVELOP.	13.1	17.8	12.4		7.5
INSTALLED BY	BECH/G&M	BECH/G&M	BECH/G&M		BECH/G&M

WELL NUMBER OTHER NUMBER	GW-101	GW-102	GW-103	GW-104	GW-105
ZONE	W	U/W	W	F	W
SITE	S-3	S-3	S-3	S-3	S-3
NORTH COORDINATES	30241.00	29852.00	30058.00	30059.00	30417.00
EAST COORDINATES	51844.00	51810.00	52291.00	52303.00	52833.00
UNCONSOLID. MATERIAL	FL. CL	FL. CL	FL	CL	FL. CL
WEATH. ROCK MATERIAL	SH Cmn	SH Cmn	SH. Ls Cmn	SH. Ls Cmn	SH. Ls
WEATH. ROCK FORMATION					
FRESH ROCK MATERIAL	Ls Cmn			SH. Ls	Ls
FRESH ROCK FORMATION					
SAMPLE	SS	SS	SS	Cut	Cut
GROUND ELEVATION	1005.10	1003.00	1008.20	1008.50	1014.30
MEASURING POINT ELEV.	1007.40	1006.57	1011.75	1012.00	1017.57
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	14.00		0.50	1.00	10.00
TOP FRESH ROCK -DEPTH	17.50			38.00	17.00
BOTTOM OF HOLE -DEPTH	17.50	24.00	25.00	74.00	17.00
TOP WEATH ROCK -ELEV	991.10		1007.70	1007.50	1004.30
TOP FRESH ROCK -ELEV	987.60			970.50	997.30
BOTTOM OF HOLE -ELEV	987.60	979.00	983.20	934.50	997.30
TOP GRVL/SD PK -DEPTH	10.10	14.00	17.80	49.00	9.50
BTM GRVL/SD PK -DEPTH	17.50	24.00	25.00	74.00	17.00
TOP OF SCREEN -DEPTH	12.30	18.80	20.10	59.80	12.10
BTM OF SCREEN -DEPTH	16.30	22.80	24.10	68.80	16.10
TOP GRVL/SD PK -ELEV.	995.00	989.00	990.40	959.50	1004.80
BTM GRVL/SD PK -ELEV.	987.60	979.00	983.20	934.50	997.30
TOP OF SCREEN -ELEV	992.80	984.20	988.10	948.70	1002.20
BTM OF SCREEN -ELEV	988.80	980.20	984.10	939.70	998.20
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	PVC	PVC	PVC	PVC	PVC
SCREEN SLOT SIZE	0.01	0.01	0.01	0.01	0.01
CAP (MATERIAL)	SAND	SAND	SAND	SAND	SAND
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT	CEMENT	CEMENT
SUMP (Y/N. LENGTH)	YES/0.9	YES/0.9	YES/0.9	YES/1.0	YES/0.9
SURFACE CASING: RIG	AUGER	AUGER	AUGER	ROTARY	AUGER
HOLE DIAM.. DEPTH	6.5/17.5	6.5/24	6.5/25	16/36.5	6.5/17
CASG DIAM.. DEPTH	7/2.7	7/2.0	7/2.2	10/35.7	7/2.5
WELL CASING: RIG	AUGER	AUGER	AUGER	ROTARY	AUGER
HOLE DIAM.. DEPTH	6.5/17.5	6.5/24	6.5/25	9/74	6.5/17
CASG DIAM.. DEPTH	2/17.2	2/23.7	2/25	4/69.8	2/17
CASING MATERIAL	PVC	PVC	PVC	PVC	PVC
BEGUN (DATE)	12-Sep-84	13-Sep-84	13-Sep-84	20-Sep-84	18-Sep-84
COMPLETED (DATE)	12-Sep-84	13-Sep-84	13-Sep-84	21-Sep-84	18-Sep-84
DEVELOPED (DATE)	18-Oct-84	18-Oct-84	18-Oct-84	18-Oct-84	19-Oct-84
WELL VOLUMES DEVELOP.	7.7	11.9	10.7	12.1	5.6
INSTALLED BY	BECH/G&M	BECH/G&M	BECH/G&M	BECH/G&M	BECH/G&M

WELL NUMBER OTHER NUMBER	GW-106	GW-107	GW-108	GW-109	GW-110
ZONE	F	W	F	F	F
SITE	S-3	S-3	S-3	S-3	G C
NORTH COORDINATES	30418.00	30080.00	30070.00	30056.00	28744.61
EAST COORDINATES	52843.00	53206.00	53207.00	53207.00	21994.66
UNCONSOLID. MATERIAL	CL	FL	FL CL	FL, CL	SD. CL
WEATH. ROCK MATERIAL	SH, Ls	SH, Ls	SH, Ls	SH, Ls	SH
WEATH. ROCK FORMATION	Cn	Cmn	Cmn	Cmn	
FRESH ROCK MATERIAL	SH, Ls	Ls	Ls	Ls	SH, Ls
FRESH ROCK FORMATION	Cn	Cmn	Cmn	Cmn	
SAMPLE	Cut	Cut	Cut	Cut	Cut Cut, Core
GROUND ELEVATION	1014.50	995.90	995.80	995.30	863.30
MEASURING POINT ELEV.	1016.73	998.37	998.83	997.64	866.35
MEASURING POINT	TOC	TOC	TOC	TOC	TOC
TOP WEATH ROCK -DEPTH	12.50	5.00	4.00	4.00	20.00
TOP FRESH ROCK -DEPTH		14.20	18.00	18.00	29.30
BOTTOM OF HOLE -DEPTH	75.00	14.20	58.60	128.50	40.00
TOP WEATH ROCK -ELEV	1002.00	990.90	991.80	991.30	843.30
TOP FRESH ROCK -ELEV		981.70	977.80	977.30	834.00
BOTTOM OF HOLE -ELEV	939.50	981.70	937.20	866.80	823.30
TOP GRVL/SD PK -DEPTH	53.30	6.40	41.00	96.60	27.00
BTM GRVL/SD PK -DEPTH	75.00	14.20	58.60	128.50	40.00
TOP OF SCREEN -DEPTH	61.90	8.50	46.70	102.90	28.40
BTM OF SCREEN -DEPTH	70.90	12.50	55.70	121.90	38.60
TOP GRVL/SD PK -ELEV.	961.20	989.50	954.80	898.70	836.30
BTM GRVL/SD PK -ELEV.	939.50	981.70	937.20	866.80	823.30
TOP OF SCREEN -ELEV	952.60	987.40	949.10	892.40	834.90
BTM OF SCREEN -ELEV	943.60	983.40	940.10	873.40	824.70
SCREEN/OPEN HOLE	SCREEN	SCREEN	SCREEN	SCREEN	SCREEN
SCREEN MATERIAL	PVC	PVC	PVC	PVC	St St
SCREEN SLOT SIZE	0.01	0.01	0.01	0.01	0.01
CAP (MATERIAL)	SAND	SAND	SAND	SAND	SAND
MATERIAL ABOVE CAP	CEMENT	CEMENT	CEMENT	CEMENT	CEMENT
SUMP (Y/N, LENGTH)	YES/1.1	YES/0.9	YES/1.1	YES/1.1	YES/1.2
SURFACE CASING: RIG	ROTARY	AUGER	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	16/20	6.5/14.2	16/20.7	16/20	5/29.3
CASG DIAM., DEPTH	10/20	7/2.6	10/20.7	10/20	7/2.8
WELL CASING: RIG	ROTARY	AUGER	ROTARY	ROTARY	ROTARY
HOLE DIAM., DEPTH	9/75	6.5/14.2	9/58.6	9/147.6	3/40
CASG DIAM., DEPTH	4/72	2/13.4	4/58.6	4/123	2/39.8
CASING MATERIAL	PVC	PVC	PVC	PVC	St St
BEGUN (DATE)	26-Sep-84	17-Sep-84	26-Sep-84	27-Sep-84	14-Sep-84
COMPLETED (DATE)	26-Sep-84	17-Sep-84	26-Sep-84	27-Sep-84	14-Sep-84
DEVELOPED (DATE)	18-Oct-84	19-Oct-84	19-Oct-84	22-Oct-84	18-Oct-84
WELL VOLUMES DEVELOP.	6.1	8.4	11.6	9.8	6.9
INSTALLED BY	BECH/G&M	BECH/G&M	BECH/G&M	BECH/G&M	BECH/G&M

WELL NUMBER	GW-111	GW-112	GW-113	GW-114	GW-115
OTHER NUMBER					
ZONE		W G C	F G C	W B C	F S-3
SITE		28626.50	28633.14	28575.10	31073.48
NORTH COORDINATES		22020.66	22028.44	28100.10	52684.99
EAST COORDINATES					
UNCONSOLID. MATERIAL	C O R	CL	FL, CL	CL	CL
WEATH. ROCK MATERIAL	R E	Ls, SH	Ls	Ls	SH
WEATH. ROCK FORMATION					
FRESH ROCK MATERIAL	H O L	Ls SH	Ls, SH		Ls, SH
FRESH ROCK FORMATION	E				
SAMPLE	G R O U T E D	Cut 872.83 877.48 TOC 20.00 130.00 245.00 852.83 742.87 627.83 218.90 245.00 223.40 243.40 653.93 627.83 649.43 629.43 SCREEN St St 0.01 SAND CEMENT Y/1.2 ROTARY 9/25.2 6/24.4 ROTARY 6/245 2/244.6 St St 29-Sep-84 29-Sep-84 26-Oct-84 3.8 BECH/G&M	Cut 872.87 874.79 TOC 20.00 130.00 160.50 852.87 742.87 712.37 132.10 160.50 138.30 158.70 740.77 712.37 734.57 714.17 SCREEN St St 0.01 SAND CEMENT Y/1.1 ROTARY 9/24 6/23.4 ROTARY 6/160.5 2/159.8 St St 05-Oct-84 27-Sep-84 16-Oct-84 5.1 BECH/G&M	Cut 824.36 828.27 TOC 18.00 120.00 806.36 704.36 88.60 120.00 98.40 118.80 735.76 704.36 725.96 705.56 SCREEN St St 0.01 SAND CEMENT Y/1.2 ROTARY 9/41 6/39 ROTARY 6/120 2/120 St St 27-Sep-84 27-Sep-84 19-Oct-84 15.5 BECH/G&M	Cut 1051.92 1054.41 TOC 16.50 20.00 53.00 1035.42 1031.92 998.92 38.00 53.00 42.00 52.00 1013.92 998.92 1009.92 999.92 SCREEN St St 0.01 SAND CEMENT Y/1.0 ROTARY 9/21 6/21 ROTARY 6/57 2/42 ST St 29-Sep-84 29-Sep-84 26-Oct-84 3.8 BECH/G&M
TOP WEATH ROCK -DEPTH					
TOP FRESH ROCK -DEPTH					
BOTTOM OF HOLE -DEPTH					
TOP WEATH ROCK -ELEV					
TOP FRESH ROCK -ELEV					
BOTTOM OF HOLE -ELEV					
TOP GRVL/SD PK -DEPTH					
BTM GRVL/SD PK -DEPTH					
TOP OF SCREEN -DEPTH					
BTM OF SCREEN -DEPTH					
TOP GRVL/SD PK -ELEV.					
BTM GRVL/SD PK -ELEV.					
TOP OF SCREEN -ELEV					
BTM OF SCREEN -ELEV					
SCREEN/OPEN HOLE					
SCREEN MATERIAL					
SCREEN SLOT SIZE					
CAP (MATERIAL)					
MATERIAL ABOVE CAP					
SUMP (Y/N, LENGTH)					
SURFACE CASING: RIG					
HOLE DIAM.. DEPTH					
CASG DIAM., DEPTH					
WELL CASING: RIG					
HOLE DIAM.. DEPTH					
CASG DIAM., DEPTH					
CASING MATERIAL					
BEGUN (DATE)					
COMPLETED (DATE)					
DEVELOPED (DATE)					
WELL VOLUMES DEVELOP.					
INSTALLED BY					

> 4
BECH/G&M

GERAGHTY & MILLER, INC.

APPENDIX C

URANIUM ACTIVITY (pCi/l) IN GROUND WATER
AT THE BEAR CREEK VALLEY WASTE DISPOSAL AREA

(adapted from "Analytical Results for Water, Sediment,
and Soil Samples Collected in the Y-12 Plant,
Bear Creek Valley Waste Disposal Areas,"
Y/TS-112, June 1985)

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-1	GW-2	GW-3	GW-5	GW-6	GW-7
OTHER ID:	OL	OL	OL	OL	OL	OL
LOCATION:						
PHASE I:	18-Nov-83	18-Nov-83	18-Nov-83	18-Nov-83	17-Nov-83	17-Nov-83
PHASE II:	07-Mar-84	07-Mar-84	06-Mar-84	06-Mar-84	07-Mar-84	06-Mar-84
PHASE III:			24-Aug-84		24-Aug-84	24-Aug-84
PARAMETER	PHASE					
233+234 URANIUM	I	0.36	0	2.97	62.5	0.754
	II	0.59		1.75	29.1	1.7
	III	0.1	0.48		<0.2	<0.1
235 URANIUM	I	0.086	0	0.41	2.16	0.095
	II	0.097		0.14	1.18	0.16
	III	0	0.11		<0.1	<0.09
238 URANIUM	I	0.586	0.3	3.39	26.8	0.715
	II	0.5		1.68	11.7	0.35
	III	0.17	0.26		0.25	<0.09

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-8	GW-10	GW-11	GW-12	GW-12
OTHER ID:	OL	OL	OL	OL	OL
LOCATION:					
PHASE I:	17-Nov-83	17-Nov-83	17-Nov-83	17-Nov-83	17-Nov-83
PHASE II:	06-Mar-84	06-Mar-84	07-Mar-84	06-Apr-84	06-Mar-84
PHASE III:			24-Aug-84		24-Aug-84
PARAMETER	PHASE				
233+234 URANIUM	I	2.14	3.49	0.38	1.36
	II	0.47	0.54	0.31	0.19
	III		<0.1	0.29	<0.2
235 URANIUM	I	0.21	0.32	0	0.18
	II	0	0	0	0
	III		<0.1	0.084	<0.05
238 URANIUM	I	2.79	3.83	0	1.22
	II	0.39	0.81	0.16	0.3
	III		<0.1	0.2	<0.2

BEAR CREEK VALLEY WASTE DISPOSAL AREA; GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-13	GW-14	GW-15	GW-16	GW-17	GW-18
OTHER ID:						
LOCATION:	OL	BG	BG	BG	BG	BG
PHASE I:	18-Nov-83			09-Dec-83	09-Dec-83	09-Dec-83
PHASE II:	07-Mar-84	09-Mar-84	09-Mar-84			09-Dec-83
PHASE III:	24-Aug-84	25-Aug-84	25-Aug-84	25-Aug-84		25-Aug-84
PARAMETER	PHASE					
233+234 URANIUM	I	1.71		4.61	0.2	0
	II	0.76	2.99	2.79		
	III	0.27	2.24		1.19	<0.36
235 URANIUM	I	0.1		0.31	0	0
	II	0.18	0.34	0.27		
	III	<0.1	0.532		<0.18	<0.28
238 URANIUM	I	1.13		5.45	0	0.19
	II	1.1	8.36	2.97		
	III	<0.2	6.62		0.32	0.25

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-20	GW-21	GW-22	GW-23	GW-24
OTHER ID:					
LOCATION:	BG	BG	BG	BG	BG
PHASE I:				09-Dec-83	09-Dec-83
PHASE II: 08-Mar-84		08-Mar-84		09-Mar-84	08-Mar-84
PHASE III: 25-Aug-84				06-Apr-84	08-Mar-84
PARAMETER	PHASE				
233+234 URANIUM	I	0.81	1.64	0.14	30.2
	II	0.55		0.4	99.1
	III				0.6
²³⁵ URANIUM	I	0.16	0.17	0	7.03
	II	0.11		0	27.8
	III				0
238 URANIUM	I	0.76	1.53	0.24	277
	II	0.28		1.85	858
	III				1.68

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-26	GW-27	GW-28	GW-29	GW-30	GW-31
OTHER ID:						
LOCATION:	BG	BG	BG	BG	BG	BG
PHASE I:						
PHASE II: 08-Mar-84	08-Mar-84	08-Mar-84	08-Mar-84	10-Mar-84	09-Mar-84	09-Mar-84
PHASE III: 25-Aug-84	25-Aug-84			25-Aug-84		
PARAMETER	PHASE					
233+234 URANIUM	I	59.8	17.2	0.85	2.41	0.46
	II		13.5		2.99	
	III					
C-5	235 URANIUM	I	9.23	0.78	0	0
	II		0.43		0	0
	III					
238 URANIUM	I	472	4.93	1.23	1.92	0.32
	II		3.65		1.68	
	III					

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-33	GW-34	GW-35	GW-36	GW-37	GW-38
OTHER ID:						
LOCATION:	BG	BG	BG	BG	BG	BG

PHASE I:
 PHASE II: 10-Mar-84 10-Mar-84 08-Mar-84 09-Mar-84 09-Mar-84 10-Mar-84
 PHASE III:
 PHASE III:

PARAMETER	PHASE	233+234 URANIUM	235 URANIUM	238 URANIUM
	I	0. 9	0. 26	1. 46
	II	29	3. 02	150
	III	0. 44	0	1. 38
		1. 09	0. 16	4. 41
		0. 2	0. 14	0. 6
		3. 62	<0. 1	8. 38
		0. 65		1. 14

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-39	GW-40	GW-41	GW-42
OTHER ID:				
LOCATION:	BG	BG	BG	BG
PHASE I:		09-Dec-83	09-Dec-83	
PHASE II: 09-Mar-84	08-Mar-84	08-Mar-84	08-Mar-84	
PHASE III:	25-Aug-84	03-Apr-84	03-Apr-84	03-Apr-84

PARAMETER	PHASE	233+234 URANIUM	235 URANIUM	238 URANIUM
	I	0.59	0	0.21
	II		0.32	0.31
	III		<0.3	<0.2
			0.055	0.25
			0	0.047
			<0.3	<0.3
			0.047	0.23
			<0.1	<0.2
			0.17	0.23
			0	0.37
			0	0.37
			0.065	0.641
			0	<0.2
			0.065	0.64

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-43	GW-43	GW-44	GW-44	GW-45	GW-46
OTHER ID:	OL	OL	OL	OL	BG	BG
LOCATION:						
PHASE I: 18-Nov-83			18-Nov-83		08-Dec-83	09-Dec-83
PHASE II: 07-Mar-84	04-Apr-84	07-Mar-84	04-Apr-84	09-Mar-84	06-Apr-84	
PHASE III: 25-Aug-84		25-Aug-84			25-Aug-84	

PARAMETER PHASE

233+234 URANIUM	I	1.63	0.89	0.28	2.16	
	II	0.97	0.23	0	1.48	
	III	<0.11	0.31		<0.13	
Σ						
235 URANIUM	I	0	0.23	0.063	0	0
	II	0.26	0			
	III	<0.11	<0.13	0		
Σ						
238 URANIUM	I	1.45	0.46	0.38	2.54	
	II	0.94	0.15	0.16	1.47	
	III	0.074	0.33		<0.16	

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCU/L).

WELL:	GW-47	GW-48	GW-49	GW-51	GW-52	GW-53
OTHER ID:						
LOCATION:	BG	BG	BG	BG	BG	BG
PHASE I: 09-Dec-83			09-Dec-83		09-Dec-83	08-Dec-83
PHASE II: 08-Mar-84	09-Mar-84	09-Mar-84	09-Mar-84	09-Mar-84	09-Mar-84	08-Mar-84
PHASE III: 25-Aug-84						

PARAMETER PHASE

233+234 URANIUM	I	2.45	0.586	1.14	15.2	0.545
	II	0.689	0.1		18.7	0.76
	III	0.26				
C-9						
235 URANIUM	I	0.16	0.075	1.14	0	
	II	0.15	0.083	1.48	0	
	III	<0.1				
238 URANIUM	I	2.22	0.681	29.9	0.43	
	II	0.983	0.062	0.65	35.8	0.58
	III	0.24				

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-54	GW-56	GW-57	GW-58	GW-59	GW-60
OTHER ID:		BG	BG	BG	BG	BG
LOCATION:						
PHASE I:						
PHASE II: 05-Apr-84	05-Apr-84	05-Apr-84	05-Apr-84	05-Apr-84	05-Apr-84	05-Apr-84
PHASE III: 25-Aug-84	27-Aug-84	24-Aug-84	27-Aug-84	24-Aug-84	24-Aug-84	25-Aug-84
PARAMETER	PHASE					
233+234 URANIUM	I	6.26	3.2	4.17	4.55	3.88
	II	<0.11	0.28	1.5	2.99	0.2
	III					
235 URANIUM	I	0.393	0.27	0.21	0.24	0.236
	II	<0.04	<0.1	0.088	0.4	0.061
	III					
238 URANIUM	I	8.52	3.2	3.44	6.69	4.87
	II	0.079	<0.1	0.654	4.11	0.454
	III					

C-10

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI / L).

WELL:	GW-61	GW-62	GW-63	GW-64	GW-65	GW-66
OTHER ID:						
LOCATION:	BG	OL	OL	OL	OL	OL
PHASE I:	05 - Apr - 84	05 - Apr - 84	05 - Apr - 84	04 - Apr - 84	04 - Apr - 84	04 - Apr - 84
PHASE II:	24 - Aug - 84	24 - Aug - 84	24 - Aug - 84	27 - Aug - 84	24 - Aug - 84	24 - Aug - 84
PHASE III:						
PARAMETER	PHASE					
233+234 URANIUM	I	5.12	0.567	1.36	1.81	1.45
	II		0.25	0.847	0.39	0.41
	III					
235 URANIUM	I	0.19	0.018	0.11	0.054	0.04
	II		<0.1	<0.04	<0.1	<0.05
	III					
238 URANIUM	I	7.19	0.77	1.49	2.23	1.85
	II		0.23	0.814	0.37	0.401
	III					

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-67	GW-68	GW-69	GW-70	GW-71	GW-72
OTHER ID:	OL	BG	BG	BG	BG	BG
LOCATION:						
PHASE I;						
PHASE II: 04-Apr-84	04-Apr-84	06-Apr-84	06-Apr-84	10-Apr-84	06-Apr-84	
PHASE III:	25-Aug-84	28-Aug-84	29-Aug-84	29-Aug-84	28-Aug-84	
PARAMETER	PHASE					
233+234 URANIUM	I	29.1	1.5	0.39	8.76	0.351
	II		<0.8	<0.8	6.08	
	III	0.731				
						0.42
						1.98
C-12						
235 URANIUM	I	1.88	0.066	0.049	0.471	0.049
	II		<0.1	<0.7	0.64	
	III					
						0
238 URANIUM	I	17.1	1.24	0.402	21.7	0.485
	II		0.37	<0.7	14.7	
	III					
						0.44
						1.53

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-73	GW-74	GW-75	GW-76	GW-77	GW-78
OTHER ID:	OL	OL	OL	OL	BG	BG
LOCATION:						
PHASE I:						
PHASE II: 04-Apr-84	06-Apr-84	10-Apr-84	04-Apr-84	03-Apr-84	03-Apr-84	03-Apr-84
PHASE III: 27-Aug-84	27-Aug-84	29-Aug-84	27-Aug-84	27-Aug-84		
PARAMETER	PHASE					
233+234 URANIUM	I	0.272	0.2	0.499	0.511	0.71
	II	0.21	0.19	0.557	0.62	
	III					
235 URANIUM	I	0.011	0.028	0.034	0.06	0
	II	<0.1	<0.04	<0.05	<0.1	
	III					
238 URANIUM	I	0.266	0.17	0.839	0.681	0.48
	II	0.24	0.27	0.38	0.56	
	III					

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-79	GW-80	GW-81	GW-82	GW-83	GW-84
OTHER ID:						
LOCATION:	BG	BG	BG	BG	BG	OL
PHASE I:						
PHASE II: 03-Apr-84	03-Apr-84	03-Apr-84	03-Apr-84	03-Apr-84	04-Apr-84	04-Apr-84
PHASE III: 27-Aug-84	27-Aug-84	27-Aug-84	27-Aug-84	27-Aug-84	27-Aug-84	24-Aug-84
PARAMETER	PHASE					
233+234 URANIUM	I	0	2.46	3.49	0.815	0.071
	II	0.16	<0.2	<0.2	0.45	<0.1
	III					<0.2
235 URANIUM	I	0.072	0.058	0.054	0.025	0
	II	<0.1	<0.2	<0.1	<0.2	<0.1
	III					
238 URANIUM	I	0.21	2.07	3.34	1.46	0.141
	II	<0.1	<0.2	<0.1	0.2	<0.1
	III					

C-14

BEAR CREEK VALLEY WASTE DISPOSAL AREA; GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	GW-85	GW-86	GW-87	Y-GMW20	BG-10	BG-11
OTHER ID:	OL	OL	OL	1051	1036	1037
LOCATION:				OL	BG	BG
PHASE I:						
PHASE II: 04-Apr-84	04-Apr-84	04-Apr-84	04-Apr-84	13-Mar-84	12-Mar-84	09-Apr-84
PHASE III: 27-Aug-84	27-Aug-84	27-Aug-84	24-Aug-84			
PARAMETER	PHASE					
233+234 URANIUM	I	0.151	8.23	86.8	8.06	0.033
	II	<0.2	<0.1	136		
	III					
C-15	235 URANIUM	I	0.016	0.708	7.97	0.61
	II	<0.2	<0.1	14.3		
	III					
238 URANIUM	I	0.203	25.8	300	6.36	0.33
	II	<0.2	<0.1	451		
	III					

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM ACTIVITY
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL:	BG-12	BG-13	BG-15	BG-17	BG-18
OTHER ID:	1038	1039	1041	1043	1044
LOCATION:	BG	BG	BG	BG	BG

PHASE I:	12-Mar-84	12-Mar-84	12-Mar-84	12-Mar-84	12-Mar-84
PHASE II:	12-Mar-84	12-Mar-84	12-Mar-84	12-Mar-84	10-Mar-84
PHASE III:					

PARAMETER	PHASE				
$^{233+234}$ URANIUM	I	0.37	14.5	1.09	35.5
	II				0.19
	III				0.31

C- ¹⁶	235 URANIUM	I	0	2.21	0.1	4.12	0	0
		II						
		III						
238 URANIUM	I	1.31	95.6	1.86	152	0.16	0.26	
	II							
	III							

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
URANIUM ACTIVITY
(OL=OIL LANDFARM, BG=BURIAL GROUNDS; VALUES IN PCI/L).

WELL: BG-20
OTHER ID: 1046
LOCATION: BG

PHASE I:
PHASE II: 10-Mar-84
PHASE III:

PARAMETER PHASE

233 + 234 URANIUM	I	27.3
	II	
	III	
235 URANIUM	I	1.83
	II	
	III	

238 URANIUM	I	47.1
	II	
	III	

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APPENDIX D

URANIUM CONCENTRATIONS (ppm) IN GROUND WATER
AT THE BEAR CREEK VALLEY WASTE DISPOSAL AREA

(adapted from "Analytical Results for Water, Sediment,
and Soil Samples Collected in the Y-12 Plant,
Bear Creek Valley Waste Disposal Areas,"
Y/TS-112, June 1985)

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS, S-3=S-3 PONDS; VALUES IN PPM).

WELL:	GW-1	GW-2	GW-3	GW-5	GW-6	GW-7	GW-8
OTHER ID:	OL						
LOCATION:							
PHASE I: 18-Nov-83	18-Nov-83	18-Nov-83	18-Nov-83	17-Nov-83	17-Nov-83	17-Nov-83	17-Nov-83
PHASE II: 07-Mar-84	07-Mar-84	06-Mar-84	06-Mar-84	06-Mar-84	07-Mar-84	06-Mar-84	06-Mar-84
PHASE III:							
PHASE IV:							

PHASE

I	<2	<2	<2	<2	<2	<2	<2
II	<2	<2	<2	<2	<2	<2	<2
III	<2	<2	<2	<2	<2	<2	<2
IV							

WELL:	GW-10	GW-11	GW-11	GW-12	GW-12	GW-13	GW-14
OTHER ID:	OL	OL	OL	OL	OL	OL	BG
LOCATION:							
PHASE I: 17-Nov-83	17-Nov-83	17-Nov-83	17-Nov-83	17-Nov-83	17-Nov-83	17-Nov-83	17-Nov-83
PHASE II: 06-Mar-84	07-Mar-84	06-Apr-84	06-Mar-84	06-Mar-84	07-Mar-84	07-Mar-84	09-Mar-84
PHASE III:							
PHASE IV:							

PHASE

I	<2	<2	<2	<2	<2	<2	<2
II	<2	<2	<2	<2	<2	<2	<2
III	<2	<2	<2	<2	<2	<2	<2
IV							

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS, S-3=S-3 PONDS; VALUES IN PPM).

WELL:	GW-30	GW-31	GW-33	GW-34	GW-35	GW-36	GW-37
OTHER ID:							
LOCATION:	BG						

PHASE	I:	II: 09-Mar-84	09-Mar-84	10-Mar-84	10-Mar-84	08-Mar-84	09-Mar-84	09-Mar-84
PHASE III:								
PHASE IV:								

PHASE

I	<2	<2	<2	<2	<2	<2	<2
II							
III							
IV							

WELL:	GW-38	GW-39	GW-40	GW-41	GW-41	GW-42	GW-42
OTHER ID:							
LOCATION:	BG						

PHASE	I:	II: 10-Mar-84	09-Mar-84	08-Mar-84	09-Dec-83	08-Mar-84	03-Apr-84	09-Dec-83
PHASE III:								
PHASE IV:								

PHASE

I	<2	<2	<2	<2	<2	<2	<2
II							
III							
IV							

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS, S-3=S-3 PONDS; VALUES IN PPM).

WELL:	GW-43	GW-43	GW-44	GW-44	GW-45	GW-46	GW-47
OTHER ID:	OL	OL	OL	OL	BG	BG	BG
LOCATION:							
PHASE I:	18-Nov-83	18-Nov-83	07-Mar-84	04-Apr-84	08-Dec-83	09-Dec-83	09-Dec-83
PHASE II:	07-Mar-84	04-Apr-84	07-Mar-84	04-Apr-84	09-Mar-84	06-Apr-84	08-Mar-84
PHASE III:	25-Aug-84	25-Aug-84					
PHASE IV:					25-Aug-84	25-Aug-84	25-Aug-84

PHASE
 I <2
 II <2
 III <2
 IV

WELL:	GW-48	GW-49	GW-51	GW-52	GW-53	GW-54	GW-56
OTHER ID:	BG						
LOCATION:							
PHASE I:	09-Dec-83	09-Dec-83	09-Dec-83	08-Dec-83	08-Dec-83	05-Apr-84	05-Apr-84
PHASE II:	09-Mar-84	09-Mar-84	09-Mar-84	09-Mar-84	08-Mar-84	05-Apr-84	05-Apr-84
PHASE III:						25-Aug-84	27-Aug-84
PHASE IV:							

WELL:	GW-48	GW-49	GW-51	GW-52	GW-53	GW-54	GW-56
OTHER ID:	BG						
LOCATION:							
PHASE I:	<2	<2	<2	<2	<2	<2	<2
PHASE II:	<2	<2	<2	<2	<2	<2	<2
PHASE III:							
PHASE IV:							

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS, S-3=S-3 PONDS; VALUES IN PPM).

WELL:	GW-57	GW-58	GW-59	GW-60	GW-61	GW-62	GW-63
OTHER ID:	BG	BG	BG	BG	BG	OL	OL
LOCATION:							

PHASE I:
 PHASE II: 05-Apr-84 05-Apr-84 05-Apr-84 05-Apr-84 05-Apr-84 05-Apr-84 05-Apr-84
 PHASE III: 24-Aug-84 27-Aug-84 24-Aug-84 25-Aug-84 25-Aug-84 24-Aug-84 24-Aug-84
 PHASE IV:

PHASE

I	<2	<2	<2	<2	<2
II	<2	<2	<2	<2	<2
III	<2	<2	<2	<2	<2
IV					

WELL:	GW-64	GW-65	GW-66	GW-67	GW-68	GW-69	GW-70
OTHER ID:	OL	OL	OL	OL	BG	BG	BG
LOCATION:							

PHASE I:
 PHASE II: 04-Apr-84 04-Apr-84 04-Apr-84 04-Apr-84 04-Apr-84 06-Apr-84 06-Apr-84
 PHASE III: 27-Aug-84 24-Aug-84 24-Aug-84 25-Aug-84 25-Aug-84 28-Aug-84 29-Aug-84
 PHASE IV:

PHASE

I	<2	<2	<2	<2	<2
II	<2	<2	<2	<2	<2
III	<2	<2	<2	<2	<2
IV					

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS, S-3=S-3 PONDS; VALUES IN PPM).

WELL:	GW-71	GW-72	GW-73	GW-74	GW-75	GW-76	GW-77
OTHER ID:	BG	BG	OL	OL	OL	OL	BG
PHASE I:							
PHASE II:	10-Apr-84	06-Apr-84	04-Apr-84	06-Apr-84	10-Apr-84	04-Apr-84	03-Apr-84
PHASE III:	28-Aug-84	27-Aug-84	27-Aug-84	27-Aug-84	29-Aug-84	27-Aug-84	27-Aug-84
PHASE IV:	19-Oct-84						
PHASE							
I	<2	<2	<2	<2	<2	<2	<2
II	<2	<2	<2	<2	<2	<2	<2
III							
IV	<2						
PHASE							
WELL:	GW-78	GW-79	GW-80	GW-81	GW-82	GW-83	GW-84
OTHER ID:	BG	BG	BG	BG	BG	BG	OL
LOCATION:							
PHASE I:							
PHASE II:	03-Apr-84	03-Apr-84	03-Apr-84	03-Apr-84	03-Apr-84	04-Apr-84	04-Apr-84
PHASE III:	27-Oct-84	27-Aug-84	27-Aug-84	27-Aug-84	27-Aug-84	27-Aug-84	24-Aug-84
PHASE IV:							
I	<2	<2	<2	<2	<2	<2	<2
II	<2	<2	<2	<2	<2	<2	<2
III							
IV							

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
 URANIUM
 (OL=OIL LANDFARM, BG=BURIAL GROUNDS, S-3=S-3 PONDS; VALUES IN PPM).

WELL:	GW-85	GW-86	GW-87	GW-93	GW-94	GW-95	GW-96
OTHER ID:							
LOCATION:	OL	OL	OL	BG	BG	BG	BG

PHASE I:
 PHASE III: 04-Apr-84 04-Apr-84 04-Apr-84
 PHASE III: 27-Aug-84 27-Aug-84 27-Aug-84
 PHASE IV: 18-Oct-84 19-Oct-84 19-Oct-84 18-Oct-84

PHASE

PHASE	I	II	III	IV	I	II	III	IV
WELL:	<2	<2	<2	<2	<2	<2	<2	<2
OTHER ID:								
LOCATION:	OL	OL	S-3	S-3	S-3	S-3	S-3	S-3

PHASE I:
 PHASE II:
 PHASE III:
 PHASE IV: 18-Oct-84 19-Oct-84 18-Oct-84 18-Oct-84 18-Oct-84 18-Oct-84 18-Oct-84 19-Oct-84

PHASE

PHASE	I	II	III	IV	I	II	III	IV
WELL:	<2	<2	<2	<2	<2	<2	<2	<2
OTHER ID:								
LOCATION:								

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.

(OL=OIL LANDFARM, BG=BURIAL GROUNDS, S-3=S-3 PONDS; VALUES IN PPM).

WELL:	GW-105	GW-106	GW-107	GW-108	GW-109	GW-114	BG-10
OTHER ID:							1036
LOCATION:	S-3	S-3	S-3	S-3	S-3	BG	BG

PHASE I:							12-Mar-84
PHASE II:							
PHASE III:							
PHASE IV: 19-Oct-84	19-Oct-84	19-Oct-84	19-Oct-84	19-Oct-84	23-Oct-84	19-Oct-84	12-Mar-84

PHASE

I							<2
II							
III							
IV	<2	<2	<2	3	4. 8	<2	

WELL:	BG-11	BG-12	BG-13	BG-15	BG-17	BG-18	BG-19
OTHER ID:	1037	1038	1039	1041	1043	1044	1045
LOCATION:	BG						

PHASE I:							
PHASE II: 09-Apr-84	12-Mar-84	12-Mar-84	12-Mar-84	12-Mar-84	12-Mar-84	12-Mar-84	10-Mar-84
PHASE III:							
PHASE IV:							

PHASE

I							<2
II							
III							
IV							

BEAR CREEK VALLEY WASTE DISPOSAL AREA: GROUND-WATER QUALITY.
URANIUM
(OL=OIL LANDFARM, BG=BURIAL GROUNDS, S-3=S-3 PONDS; VALUES IN PPM).

WELL: BG-20
OTHER ID: 1046
LOCATION: BG

PHASE I:
PHASE II: 10-Mar-84
PHASE III:
PHASE IV:

PHASE

I
II
III
IV

GERAGHTY & MILLER, INC.

APPENDIX E

RADIATION STANDARDS AND GUIDELINES

(prepared by U.S. Department of Energy,
Oak Ridge Operations)

APPENDIX E

RADIATION STANDARDS AND GUIDELINES

This appendix presents several of the most important Federal radiation standards and guidelines, and describes the various ways in which they are applied. State standards are usually consistent with those of the Environmental Protection Agency and the Nuclear Regulatory Commission. States, however, are more directly concerned with the point of application of the standards; thus, their regulations in this regard will be discussed under the appropriate environmental media heading.

The NRC standards are not applicable to DOE operations, but are presented to illustrate their similarity with those of DOE and to point out, as well, how their application may differ.

I. Radiation Dose Standards

Public radiation dose standards have been issued by DOE, NRC, and EPA which are intended to limit exposures through all pathways, e.g., breathing air, water consumption, food consumption, and external radiation. The DOE and NRC standards are very similar, having the same basis. The EPA standard, however, is more stringent, since it was largely based upon limiting public exposures to levels which were considered to be "as low as reasonably achievable." Prior to establishing their standard, EPA performed a detailed study of the uranium fuel cycle industry for which the standard applies. This ALARA concept is a part of the DOE and NRC regulations, but it is not specifically quantified. (Several years ago NRC defined ALARA as \$1000 per man-rem. In practice, much larger expenditures are being made to reduce public exposures.)

DOE:

DOE Order 5480.1 states the DOE radiation exposure standards for members of the public. "Exposures to members of the public shall be as low as reasonably achievable levels (and) within the standards prescribed below."

TABLE 1

<u>Type of Exposure</u>	<u>Dose to Individuals at Points of Maximum Probable Exposure</u>	<u>Annual Dose Equivalent or Dose Commitment (mrem)*</u>	<u>Average Dose to a Suitable Sample of the Exposed Population</u>
Whole body, gonads, or bone marrow	500		170
Other organs	1500		500

*Dose commitment is the internal organ dose equivalent received over a 50-year period following intake of a radionuclide.

**An example of a "suitable sample of the exposed population" might be the residents of a nearby community.

New standards are expected to be promulgated by DOE in the near future consistent with the most recent recommendations of the National Council on Radiation Protection and Measurements. (See EPA air standards for further information on these recommendations.)

NRC:

The NRC radiation exposure standards for members of the public are contained in the Code of Federal Regulations 10 CFR 20.105. "There may be included in any application for a license or for amendment of a license proposed limits upon levels of radiation in unrestricted areas resulting from the applicant's possession or use of radioactive material and other sources of radiation. Such applications should include information as to anticipated average radiation levels and anticipated occupancy times for each unrestricted area involved. The Commission will approve the proposed limits if the applicant demonstrated that the proposed limits are not likely to cause any individual to receive a dose to the whole body in any period of one calendar year in excess of 0.5 rem."

EPA:

EPA has issued environmental standards (40 CFR 190) for the uranium fuel cycle that are applicable to those portions of uranium enrichment operations that directly support the production of electrical power for public use utilizing nuclear energy. These standards came into effect December 1, 1979.

Operations are to be conducted in such a manner as to provide reasonable assurance that the "annual dose equivalent does not exceed 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public as the result of exposures to planned discharges of radioactive materials, radon and its daughters excepted, to the general environment and to radiation from these operations."

II. Radioactivity in Air Standards/Guidelines

DOE uses air concentration guides as guidelines only, whereas the corresponding NRC values are considered to be maximum permissible concentrations, or standards. A second difference is that NRC in most licensing actions applies their concentration limits to site boundaries rather than to the location of maximum offsite exposure.

EPA has not issued concentration guides or concentration standards. Instead, they recently issued radiation dose limits which apply to the dose received by the public as a result of airborne emissions from DOE facilities. Compliance with these new EPA standards will generally be based on dispersion calculations rather than through environmental measurements.

DOE:

As previously stated, DOE has established radiation dose standards for members of the public which must be met by DOE operations. Air concentration guides were derived in most cases from these standards and are also presented in DOE Order 5480.1. These guides are reduced by a factor of three when applied to a suitable sample of the population. These guides assume continuous exposure for 168 hours per week, 52 weeks per year; therefore, they are most meaningful when compared with annual average air concentrations. When a mixture of radionuclides are present, these guides must be adjusted so that the maximum individual and population exposures are within the prescribed limits.

TABLE 2

<u>Isotope</u>	<u>Soluble/Insoluble</u>	<u>$\mu\text{Ci/mL}$</u>
U-234	S	2×10^{-11}
U-234	I	4×10^{-12}
U-235	S	2×10^{-11}
U-235	I	4×10^{-12}
U-238	S	3×10^{-11}
U-238	I	5×10^{-12}

NRC:

A licensee shall not release radioactive materials to unrestricted area in concentrations which exceed the limits specified in Appendix B, Table II, (Code of Federal Regulations, Chapter 10, Part 20) except as noted below. Concentrations may be averaged over a period not greater than one year.

TABLE 3
(Appendix B Table II)

<u>Isotope</u>	<u>Soluble/Insoluble</u>	<u>$\mu\text{Ci}/\text{ML}$</u>
U-234	S	2×10^{-11}
U-234	I	4×10^{-12}
U-235	S	2×10^{-11}
U-235	I	4×10^{-12}
U-238	S	3×10^{-12}
U-238	I	5×10^{-12}

A Licensee will be allowed to apply these same limits at the location of the maximally exposed individual if NRC is satisfied that the licensee has made a reasonable effort to minimize the radioactivity contained in effluents to unrestricted areas. (This exception is rarely granted.)

NRC may reduce licensee effluent limits if it is determined that a suitable sample of an exposed population group would be exposed to radioactive materials, through air, water or food intake, equivalent to that received from continuous exposure to air or water containing one-third of these concentrations.

EPA:

On January 17, 1985, the EPA published final rules (40CFR 61) for radionuclides in support of Clear Air Act National Emission Standards for Hazardous Air Pollutants. For existing sources the standards take effect 90 days after publication in the Federal Register. These standards limit radionuclide emissions from DOE facilities to an amount that causes a dose equivalent rate of 25 mrem/year to the whole body or a dose equivalent rate of 75 mrem/year to the critical organ of any member of the public. In addition, EPA will grant a waiver of these limits, if a facility operator demonstrates that no member of the public will receive a continuous exposure of more than 100 mrem/year effective dose equivalent and a noncontinuous exposure of more than 500 mrem/year effective dose equivalent from all sources, excluding natural background and medical procedures. (These latter provisions embody the recommendations of the National Council on Radiation Protection and Measurements for exposure to external radiation.) Compliance with the standard will be determined by calculating the dose to members of the public at the point of maximum annual air concentration in an unrestricted area where any member of the public resides or

III. Radioactivity in Water Standards/Guidelines

As in the case of air, DOE and NRC have concentration guides and maximum permissible concentrations, respectively. In practice, both are applied to the site boundary. Thus, the major difference is that one is a guide and the other a legally imposed limit.

EPA has issued drinking water standards for most radioactive materials, but not uranium. While these standards, as issued, apply to the quality of water when it reaches the user of a public water system, they are commonly adopted by states as surface water and groundwater quality standards, e.g., by water quality or hazardous waste organizations. When applied to surface waters, these standards usually apply to all portions of streams classified for drinking water use. Also, streams which have not been classified due to their small size are classified by default for all uses, including drinking water. Groundwaters are also classified for differing uses depending upon factors such as existing water quality and the amount of groundwater which can be pumped for use.

DOE:

The discussion regarding DOE air concentration guides applies to water concentration guides as well. These guides for water as shown in DOE Order 5480.1, are as follows:

TABLE 4

<u>Isotope</u>	<u>Soluble/Insoluble</u>	<u>µCi/mL</u>
U-234	S	4×10^{-6}
U-234	I	3×10^{-5}
U-235	S	4×10^{-6}
U-235	I	3×10^{-5}
U-238	S	6×10^{-7}
U-238	I	4×10^{-5}

It should be noted that DOE's soluble uranium numerical guides, since 1981, have been more restrictive than those previously in effect reflecting the use of more current data on the uptake of uranium through the gastrointestinal tract.

NRC:

A Licensee shall not release radioactive material to an unrestricted area in concentrations which exceed the limits specified in Appendix B, Table II, (Code of Federal Regulations, Chapter 10, Part 20) except as noted below. Concentrations may be averaged over a period not greater than one year.

TABLE 5
 (Appendix B, Table II)

<u>Isotope</u>	<u>Soluble/Insoluble</u>	<u>$\mu\text{Ci/mL}$</u>
U-234	S	3×10^{-5}
U-234	I	3×10^{-5}
U-235	S	3×10^{-5}
U-235	I	3×10^{-5}
U-238	S	4×10^{-5}
U-238	I	4×10^{-5}

A Licensee will be allowed to apply these same limits at the location of the maximally exposed individual if NRC is satisfied that the licensee has made a reasonable effort to minimize the radioactivity contained in effluents to unrestricted area. (This exception is rarely granted.)

NRC may reduce licensee effluent limits if it is determined that a suitable sample of an exposed population group would be exposed to radioactive materials through air, water, or food intake equivalent to that received from continuous exposure to air or water containing one-third of these concentrations.

EPA:

EPA has established drinking water standards that include many radionuclides, but not uranium. Nevertheless, the existence of these standards for other radionuclides is relevant to gaining a perspective as to the significance of uranium concentrations in water. Also, for the past few years, EPA has been evaluating an appropriate drinking water standard for uranium. This standard is presently expected to fall within a range of $10 - 40$ picocuries per liter, which equates to $1.0 \times 10^{-8} - 4.0 \times 10^{-8} \mu\text{Ci/ML}$.

These EPA radiation standards, as promulgated in 40 CFR 141, apply in water which is delivered to the free flowing outlet of the ultimate user of a public water system.

IV. Radioactivity in Soil Guidelines

The NRC has established guidelines for uranium in soil in unrestricted areas. DOE's determinations are on a case-by-case basis. Experience to date shows both agencies to be using similar guidance.

DOE:

The Department of Energy's Formerly Utilized Sites Remedial Action Program establishes uranium soil clean-up criteria on a case-by-case basis in conjunction with the State agencies involved. Since potential land use will vary, small differences in clean-up criteria may result. To date, uranium criteria for unrestricted use have been in the 35 - 40 pCi/g range.

NRC:

The Nuclear Regulatory Commission has issued a Branch Technical Position on uranium in soil levels permissible for unrestricted use of property. These levels are as follows:

-TABLE 6

<u>Material</u>	<u>pCi/g</u>
Depleted Uranium:	
Soluble	35
Insoluble	35
Enriched Uranium:	
Soluble	30
Insoluble	30

Miscellaneous Environmental Media

There are no specific standards or criteria in general use for uranium in sediments, vegetation, fish, or other edibles. Instead, acceptable levels would be determined on the basis of assuring that the applicable exposure limit is not exceeded through the sum of all pathways to individuals or to suitable samples of the exposed population.

In the case of sediments, clean-up criteria would be established using such factors as the likelihood of the sediment being used as topsoil, and its contribution to uranium reaching fish and their ultimate consumption by humans. Since the uptake of uranium in fish is very small, the first factor is normally of more relevance in establishing the need for remedial actions.